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1912.

Volume XXVI.

1913.

THE
OTTAWA NATURALIST

Being Volume XXVIII of the

TRANSACTIONS

OF THE

OTTAWA FIELD-NATURALISTS' CLUB.

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Incorporated March, 1884.

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The Ottawa Field-Naturalists' Club.

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REPORT OF THE COUNCIL OF THE OTTAWA FIELD-
NATURALISTS' CLUB FOR THE YEAR ENDING
MARCH 19TH, 1912.

During the past year eight meetings of the Council have been held, at which the attendance has been good. For the most part these meetings were for routine work of passing accounts, receiving reports, electing new members, arranging for excursions in the spring months, and lectures in the winter, and so forth. The items of special interest were the meetings of the Royal Society of Canada, which were held in the Carnegie Library, on the 16th, 17th and 18th of May. The President of the Club was elected as delegate, and presented a report of our work to be printed in the Proceedings of the Royal Society. Several other members were present and took part in the proceedings.

How to obtain more funds for the publication of THE OTTAWA NATURALIST was a question that came up several times. The arrangement proposed by the Publications Committee will be presented.

Shortly after the arrival of H.R.H. the Duke of Connaught, a letter was sent to him requesting that he continue the custom of other Governors-General and act as Patron of the Club. To this he graciously consented.

The Committee appointed early in 1909 to deal with a suitable memorial to the late Dr. James Fletcher, have completed their labors. In addition to the memorial fountain placed on the Experimental Farm, and unveiled on July 19th, 1910, they purchased with the surplus a painting by Mr. Franklyn Brownell, R.C.A., pronounced an exceedingly good likeness of Dr. Fletcher; this painting was unveiled at a meeting of the Club, held on Jan. 9th, 1912, and it is now hung in a prominent place in the Carnegie Library. Our thanks are due to the Committee for the very satisfactory manner in which they have discharged their duties.

MEMBERSHIP.

During the past year 16 new members have been elected, 15 members have sent in their resignation, and 3 have died. This leaves our present membership 309, composed of 302 active members and 7 corresponding members.

We regret to record the death on the 12th of March of one of our oldest corresponding members, Prof. John B. Smith, D.Sc., of Rutgers's College, New Brunswick, N.J.

PUBLICATIONS COMMITTEE.

During the past year several meetings of the Committee have been held. One of the most important matters discussed was the expense of publishing THE OTTAWA NATURALIST, and how more funds could be obtained, so as to relieve as much as possible our somewhat straitened financial circumstances. The Committee recommends that in the next volume the numbers for June and July, as well as those for August and September be combined. This will reduce the numbers published by two, and, of course, help to lessen expenses.

We desire to express our appreciation of the good work done by our Editor, Mr. Arthur Gibson, during the past year. In the face of many embarrassing difficulties he has continued to issue creditable numbers. We trust that these difficulties will soon be overcome, and that the Club may be able to publish a larger and even more creditable edition in future.

We also wish to congratulate the Club on its choice of Librarian, Mr. A. E. Attwood. Through his excellent work, assisted by Mr. A. E. Currie, at the Osgoode Street Public School, the publications of the Club have been arranged in suitable quarters and in convenient position.

The Report of the Librarian is as follows:—

The library of the Club, consisting chiefly of about 325 bound volumes, is placed on the north-west stack of the second floor of the Carnegie Library building. On the shelves of the same stack are a considerable number of unbound volumes and also magazines received in exchange for THE OTTAWA NATURALIST. Among the latter are:—

The Auk,
The Ohio Naturalist,
The Wilson Bulletin,
The Nature Study Review,
The Journal of Geography,
Le Naturaliste Canadien,
The Canadian Entomologist,
Torreya,
The Journal of the New York Entomological Society.

A little over a year ago the surplus copies of THE OTTAWA NATURALIST were transferred from the Geological Survey Museum to a room in the attic of the Osgoode Street School. All the copies of the Naturalist issued since April, 1895, that is, from Vol. IX onwards, have been arranged in a very orderly manner by Mr. A. E. Currie, who did this work voluntarily some months ago,

It has been frequently mentioned that there were about ten complete sets of the *Naturalist* still available. From Mr. Currie's work, however, it would seem as if this is not the case. There are five parcels each bearing the legend, "Nos. required to complete this set, Sept., 1891; Apr., 1892; Jan., 1895; Feb., 1895, and Mar., 1896." If these five missing numbers were supplied to each parcel, the Club would then possess five complete sets.

It is quite possible that there are several members of the Club who would be glad to present the Council with copies of the numbers required to make these sets complete.

EXCURSIONS COMMITTEE.

In accordance with suggestions made at the last Annual Meeting, the number of outings arranged for the spring months was reduced to one a fortnight, and this was further reduced when the June ones were omitted on account of wet weather or other causes. It is a regrettable fact that far too few of the members availed themselves of the opportunities thus afforded for study; for many of us these are the best and almost the only occasions when field study is possible.

The outings held were:—

April 29th—Mechanicsville.

May 13th—Beaver Meadow.

May 27th—Gilmour's Grove, Chelsea.

A full report of each of these has appeared in *THE OTTAWA NATURALIST*.

LECTURES COMMITTEE.

Shortly after the last Annual Meeting there was a most interesting lecture on the Song Birds of England, by Mr. W. E. Saunders, of London, Ont. This lecture was the result of personal observations on the journey across the ocean, and during the course of a short visit to England. So many English birds are named from their song that, as the lecturer remarked, one has just to listen and the birds will tell their names. He gave good imitations of these, but the finest thing was the reproduction by the gramophone of the song of the nightingale.

During the winter season of 1911-12 there were eight lectures given under the auspices of the Club, including two that were given under joint auspices, the first with the Ottawa Horticultural Society, and our eighth with the officials of the Normal School. Six of these lectures were held in the Assembly Hall of the Normal School, and were illustrated with lantern views. They were well attended and of unusually great interest. The lectures under our own auspices were all given by leading scientists of Ottawa, whose services we were fortunate in secur-

ing. Two of these lectures were given in the Carnegie Library Hall, and were admirably illustrated with specimens. The last lecture of the series was given by Mr. C. W. Nash, Biologist of the Provincial Museum, Toronto.

The programme as carried out was as follows:—

- November 14th, 1911—"Landscape Gardening." Prof. F. A. Waugh, Amherst, Mass.
- November 28th, 1911—"The Big Game of the Ottawa Valley." Prof. E. E. Prince, Dominion Commissioner of Fisheries, Ottawa.
- December 12th, 1911—"Some Insect Friends and Foes." The President, Mr. Alex. McNeill, Chief of Fruit Division, Ottawa.
- January 9th, 1912—"Water and Health." Prof. F. T. Shutt, M.A., Chemist, Central Experimental Farm, Ottawa.
- January 23rd, 1912—"Habits of Some Turtles and Batrachians." E. A. LeSueur, Esq., Ottawa.
- February 13th, 1912—"Variation in Plant Life, its biological significance and practical value." M. Oscar Malté, Ph.D., Ottawa.
- February 27th, 1912—"The Evolution of the World." J. S. Plaksett, B.A., F.R.S.C., Dominion Observatory, Ottawa.
- March 12th, 1912—"Our Native Birds." Mr. Charles W. Nash, Biologist, Provincial Museum, Toronto.
- March 19th, 1912—ANNUAL MEETING. Election of Officers, Annual Reports, Etc.

REPORTS OF BRANCHES.

THE BOTANICAL BRANCH.

During the past session nine meetings have been held at the homes of different members. Three were held last spring, and the remainder during the past winter. These have on the whole been rather better attended. The subjects discussed have been interesting and practical.

The following is the list:—

- 1.—"A recent visit to Florida and Georgia," by Mr. R. B. Whyte. March 25th, 1911.
- 2.—"Hybrids. How to recognize them and their systematic value," by Dr. M. O. Malté. April 8th, 1911.
- 3.—"Variations in the Wild and Cultivated Species of the Rosaceæ," by Mr. W. T. Macoun. April 22nd, 1911.
- 4.—"Our Summer's Work," by Mr. R. B. Whyte. Dec. 1st, 1911.
- 5.—"Seed types in Fodder Plants: their practical and biological significance," by Dr. M. O. Malté, Dec. 16th, 1911.

- 6.—“Forest growth in Pontiac Co., and other notes,” by Dr. H. M. Ami. Jan. 13th, 1912. This was followed by a discussion on the formation of a botanical garden at Ottawa.
- 7.—“The Wild Oat, and its relations to the cultivated oats,” by Mr. G. Michaud. Jan. 27th, 1912.
- 8.—“Some specimens and results from plant selection,” by Prof. L. S. Klink, of Macdonald College. Feb. 10th, 1912.
- 9.—“How to make the most of a small garden,” by Messrs. R. B. Whyte and J. E. Buck. March 9th, 1912.

The field work, about Ottawa, in botany, in 1911, was confined mainly to the work done by Prof. John Macoun, who spent the summer in this district in order to complete a list of the Ottawa flora, on which he has been engaged for some time. All that remains now to be done is to get the records of one or two collectors whose specimens he has not yet been able to see. During the summer 40 species of flowering plants have been added to the list.

Preparations have been made and work has begun in the laying out of a botanic garden at the Central Experimental Farm, in which it is intended to grow the native Canadian plants. Mr. H. T. Gussow, Dominion Botanist, who has this work in charge, desires the co-operation of the members of the Club, and hopes to obtain many specimens from them. Permanent and conspicuous labels are now being prepared under his direction. These will have, in plain letters, the common and scientific names of the plant, the country or district to which it is native, and the date of planting.

In a visit to Sable Island in September, 1911, Mr. Gussow collected about 100 native species of plants, and added to the list of flowering plants the heather, *Calluna vulgaris*. He also obtained specimens of four species of the more conspicuous fungi, and a number of microscopic ones.

THE ENTOMOLOGICAL BRANCH.

The Entomological Branch reports that fair progress has been made in the compilation of the list of the Insects of Canada and Newfoundland, which is being prepared by a special committee of the Entomological Society of Ontario. In the preparations of this list Dr. C. Gordon Hewitt is chairman of the sub-committee on Diptera; Mr. Arthur Gibson, of the sub-committee on Lepidoptera, and Mr. J. M. Swaine, of the sub-committee on Coleoptera. Mr. Swaine is now engaged at the Central Experimental Farm as Assistant Entomologist for Forest Insects and is a welcome addition to the branch.

Progress has also been made in the list of the insects of the Ottawa District, and several additions have been added

during the year. In the October-November number of THE OTTAWA NATURALIST a first list of local Geometroidea was published, in which 168 species were included

THE GEOLOGICAL BRANCH.

The past year has been marked by a number of interesting and important paleontological finds by amateurs, and a considerable activity in this district by the Geological Survey.

The most notable find of the season was made by Mr. J. E. Narraway, who was so fortunate as to discover a very perfect little starfish at City View. Not only are good star fishes very rare in themselves, but this specimen has covering plates over the ambulacral grooves, a feature previously entirely unknown among the free echinoderms, and showing a connection of the star fishes with the more primitive stalked echinoderms, the cystids and crinoids.

Next in importance was the discovery by Miss A. E. Wilson of a number of specimens of a plicated *Triplecia*, in the lower beds of the Utica at Dow's lake. This proved to be a new species, and is of very considerable interest in its bearing upon the correlation of the beds in which it was found with beds containing a similar *Triplecia* in Minnesota.

Both Messrs. W. J. Wilson and E. D. Ingall were fortunate finders of entire specimens of *Asaphus canadensis* Chapman, near the locality in which Miss Wilson found the *Triplecias*. Entire specimens of *A. canadensis* had been found at Collingwood and Oshawa, but, with the exception of a single small specimen in the Stewart collection (from New Edinburgh), they have not previously been found at Ottawa. Mr. Wilson found several very good specimens, and Mr. Ingall's single specimen was of great importance, for, being in limestone, it retained the natural convexity, and showed the course of the facial suture, a feature of prime importance. It is now possible to show that the species really belongs to the genus *Ogygites*, and it is, so far as known, the only American representative of that French and Russian genus.

Another interesting addition to the fauna at Ottawa was made by Mr. W. A. Johnston, who, while attending the field outing of the Club last spring at Mechanicsville, found a number of specimens of *Nanno aulema* Clarke, in the Black River limestone. Dr. Percy E. Raymond added three new species of *Bathyrurus* to the local fauna, two of them from the Pamelia near Westboro, and one from the lower part of the Trenton in Eastview.

For the Geological Survey, Mr E. D. Ingall and Dr. Raymond, did a considerable amount of work throughout the season, and

their results will be incorporated in reports to be issued by the Survey.

The Treasurer's report shows a balance on hand of \$13.85.

The thanks of the Club are due to Principal White for the use of the Normal School Hall, to the Library Board of the City Council and to the Librarian of the Carnegie Library, for the use of the lecture and committee rooms of that building, to the gentlemen who have so kindly assisted us in our winter lecture course, and to the Press of the city for its co-operation in furthering the work of the Club.

All of which is respectfully submitted.

E. H. BLACKADER, *Secretary*.

OBITUARY.

WILLIAM WHITE.

Lieut.-Col. William White, C.M.G., first President of the Ottawa Field-Naturalists' Club, died at his residence, 185 Wurtemberg Street, Ottawa, on Tuesday, April 2nd, 1911, after an illness extending over a month.

The late Lieut.-Col. White was born in London, England, Jan. 6, 1830. He received his education in a private school and entered the Imperial civil service in 1846. In 1854, he came to Ottawa and entered the money order branch of the Post Office Department and in January, 1861, was made secretary of the department. In July, 1888, he succeeded W. H. Griffin, C.M.G., as deputy Postmaster-General of Canada. This position he held until June, 1897, when he retired.

Lieut.-Col. White was probably more widely known as a military man. In 1859 he entered the Canadian Militia and since that year served in the 3rd Battalion of the Toronto Militia, the Civil Service Regiment, the Governor-General's Foot Guards, and the 43rd Duke of Cornwall's Own Rifles.

Above all things the late Colonel was a lover of nature and spent much time in his garden, experimenting with flowers, fruits and vegetables. He was deeply interested in the work of the Ottawa Field-Naturalists' Club, being one of its founders in 1879, and as mentioned above was our first President. His was a familiar figure for many years at the Club's summer excursions, at which his kindly and genial personality made him one of our most popular and esteemed members.

He was also the first president of the Ottawa Horticultural Society. In addition he has been president of the Ottawa Athenaeum and Mechanical Institute and of St. George's Society. He was made a C.M.G. on completion of the 60th year of Her Majesty's reign, 1897.

F.T.S.

TREASURER'S STATEMENT FOR YEAR ENDING
19TH MARCH, 1912.

— — —
RECEIPTS.

Balance from year 1910-11.....	\$ 21.88	
Subscriptions:—		
Arrears.....	\$ 75.00	
1911-12.....	194.35	
1912-13.....	37.00	
	<hr/>	\$306.35
Advertisements in Ottawa Naturalist.....		101.70
Ottawa Naturalists sold.....		2.95
Author's Extras sold.....		42.95
Maps of Ottawa sold.....		.20
Grant from Ottawa Horticultural Society for lecture expenses.....		25.00
Government Grant.....		200.00
		<hr/>
		\$701.03

EXPENDITURE.

Printing Ottawa Naturalist, Vol. XXV, 11 numbers, including cover.....	\$402.39	
Illustrations.....	29.25	
Author's Extras.....	59.26	
Miscellaneous printing, circulars, mailing, en- velopes, etc.....	16.66	
	<hr/>	507.56
Postage on Ottawa Naturalist.....	28.82	
Editor.....	50.00	
	<hr/>	586.38
Lecture expenses.....		72.55
Sundry expense, postages, circulars, etc.....		28.25
Balance.....		13.85
		<hr/>
		\$701.03

W. T. MACOUN,
Treasurer.

Examined and found correct,

J. BALLANTYNE,

E. C. WIGHT,

Auditors.

THE MOON AND THE WEATHER.*

OTTO KLOTZ, LL.D., F.R.A.S.

We have learned of the physical constitution of the moon, of her volume and mass, of her phases and rotation, of her borrowed light, of her gravitational or tidal effect on the earth—and now what about her connection with our weather, what about change of the moon, change of weather?

Let us calmly do a little bit of reasoning about this; let us use just a little bit of common sense, and see what conclusion we inevitably arrive at.

The change of the moon, what does it mean? Changing from more light to less, or less to more; that is all, and that goes on constantly, uniformly, from day to day. Practically, there is as much change on any one day as on any other day, so that change of moon as designating something apart from every day occurrence is in reality a misconception. Even if we were to admit certain changes as something quite apart from other lunar characteristics, we will ask, what is it that distinguishes them from other times? The only answer is, that the amount of light we receive is different from that at other times. We all know that the sun is the cause and source of the circulation of our atmosphere, upon which depends our weather. Now, the light received by the full moon is about the 1-600,000 part that of the sun, and, of course, for the other phases still less, vanishing completely at new moon, being on the average only the one millionth that of the sun, which is equivalent to saying that the sun gives us as much light and heat in 30 seconds as the moon does in a year.

Is it then reasonable to expect that the changes in quantity of this minute amount of light—of which furthermore only a fraction is available as heat, for to have any effect on weather we have to deal with heat rays—this diluted light, this homeopathic emanation, would have any effect on our weather? Certainly not. And, remember that when it is new moon or change in Halifax, it is new moon in Ottawa, in Winnipeg, in Calgary, in Vancouver; indeed it is new moon in Japan, in Siberia, in Russia, in England, in Australia, in New Zealand, in Africa, in fact, everywhere. With one accord, however, our weather-wise moon prophets shout, "change in the weather." Don't you think this is a pretty big contract to turn the crank at this particular moment of "change," to change the weather over the whole

*(Note: On Feby. 29 last Dr. Klotz gave a popular illustrated address at the Observatory on "The Moon". We give the following extract, in which he refers to the Moon and the Weather, as it will undoubtedly be of particular interest to our readers. Editor).—

globe? Think of the very marked change we had a week ago to-day, that storm; it was on the 22nd, new moon or "change" was on the 18th. Furthermore "Old Probabilities" knew that change of weather and storm were coming, for the day before it was about 700 miles to the southwest of us, and our weather generally comes from the west. A beautiful example that of simultaneity of "change of moon, change of weather."

But this is not all. Popularly, there are four changes of the moon in a month, although the new moon change holds, I think the principal place as weather changer. We thus have a "change of moon" every week through the four quarters, so that we have four yanks of the weather crank per month, simultaneous over the whole world. It is so rational, is it not? The whole scientific world or at least the whole world of meteorologists is trying to learn to predict changes of weather by studying the dynamics of the atmosphere, the dynamics of the sun, the rotational effect of the earth, the modifications by land and sea, and yet has failed to discover so simple a rule as "change of the moon, change of weather." As I have already said, in reality there is a change of the moon every day, every instant, which shows the absurdity of selecting any one or four changes as being more potent than others, which are continually taking place.

This superstition of the moon and weather is deep-rooted, I admit. It exists over the whole earth, amongst civilized and uncivilized peoples. If any of these moon-weather wise would take the trouble to note the state of the weather day by day, and compare such with the phases of the moon—or change of the moon—they would soon discover the unreliability of any prediction they might make, in short, would find what scientists have found by close study and observation in every civilized country over the globe that there is absolutely no connection between the moon and weather.

Now, this belief in the influence of the moon on the weather, I venture to say, has not for many generations been evolved by any person from his own recorded observations, but it has been handed down from generation to generation, from father to son, from mother to daughter, and it is so much easier to believe a thing than to try and find it out for yourself. If by chance, change of moon is immediately followed by change of weather, the fact is riveted in the mind to perpetuate the tradition, and if it doesn't fit—well, it's forgotten. Hence, we have the spectacle, the sad, the deplorable spectacle, in this year of grace 1912, in this age of enlightenment, of men and women clinging to this false weather-god. And who are these people that entertain this belief, are they only our ignorant, our common plebians? No, you will find included, men who are intelligent, who are

learned, even professional men and men ornamenting the bench, infected with this *bacillus lunae*.

To this weather superstition is associated superstition of the influence of the moon on man and beast, animate and inanimate matter, for example: sleeping in moonlight causes deformation and distortion of the face as well as sickness (a common belief among sailors); fish are poisoned when exposed to moonlight; the full moon drives away clouds, the French cover this by the proverb—*la lune mange les nuages*—(why not the sun?); farmers kill their hogs at certain phases of the moon, so that the fat swells and not shrivels in converting it to lard; similarly shingles are laid that they will not turn up; fence-posts are set so that they may draw down and not up; sweet-peas, other peas and seeds are planted to conform with the phases of the moon—and a lot of other nonsense.

My friends, all this is humbug, humbug, humbug. The moon has no more to do with the weather and those other things than I have to do with the digging of the canals of Mars. Hence, I ask you, implore you, beseech you, entreat you, exhort you, beg of you, to spread the gospel of truth, combat this superstition, destroy this false weather-god, crush this belief, build a funeral pyre and burn this heirloom of ignorance and superstition, although such heirlooms die hard.

If you do such, your visit here to-night has not been in vain.

A SWAMP.

BY FAITH FYLES C.E.F., OTTAWA.

The swamp to which I should like to introduce the reader, if he does not already know it, is one belonging to Mr. S. Chilcott, on the shore of Lake Johnson about $4\frac{1}{2}$ miles from North Wakefield station. This swamp is quite accessible. Mr. Chilcott owns both a telephone and a 'bus as well as the swamp, and he is very willing to meet you at the station, to drive you to the swamp, to provide a dinner and a guide, and in short, to arrange everything very nicely for you. In front of the swamp there is a little stream looked upon by some as the Rubicon, on the other side of which lies the land of the enemy in the form of black flies and mosquitoes; but those who love wild flowers see beyond, only one more delightful hunting ground. There is a rough road through the swamp which was made by cutting down the trees and allowing them to remain where they happened to fall. This is a little difficult at first, but you soon reach a smoother

path which, in June when the marsh-marigolds are out, winds like a brook of gold among the dark fir-trees and larches festooned fantastically with grey-green Spanish moss. Through their interlaced branches and fine network of needles the sunlight threads itself iridescently and incrusts the dew-wet grasses with jewels. Here are found the delicate white flowers of the Gold-thread, *Coptis trifolia* (L.) Salisb., the Star Flower, *Trientalis americana* (Pers.) Pursh., the Smilacinas, *S. trifolia* and *S. stellata* (L.) Desf., the wild Lily-of-the-Valley, *Maianthemum canadense* Desf., the sweet white Violet, *Viola blanda* Willd., the Wood Anemone, *A. quinquefolia* L. and the finely formed little blossoms of *Mitella nuda*. The flowers of the true Mitrewort, *Mitella diphylla* were nearly over when we were there, only an occasional one was left at the top of the stalk, but the lower mitres were bursting with seeds, looking like bits of jet in chalices of jade. The False Mitrewort, *Tiarella cordifolia* L. was still in bloom, in groups under the trees being much more representative of its other name "Foam Flower." Beside these, lay the greenish flowers of the Clintonias and the *Cornus canadensis*, relieved by the shell-pink bells of the *Linnaea borealis*. Just at this point in the path, on a former visit ten days earlier (24th May), I was fortunate enough to find one of the chef d'oeuvres of nature—that incomparable little orchid *Calypso bulbosa* (L.) Oakes. Like the goddess of silence whose name it bears, it makes its home in quiet secluded spots—most unexpected places. I found it quite by accident. As we were then approaching the swamp proper and sinking to the tops of our rubber boots, to gain a firmer footing I pulled aside a cedar bough and so brought to view the little Calypso in a bed of moss, among a tangled mass of boughs and broken branches. Its tapering amethystine sepals and petals outspread, its waxen pouch and transparent overleaf marked with madder and hung from a slender scape, its solitary green leaf springing from a second small corm, its very delicacy in its rough surroundings make it easily recognisable and quite unforgettable.

We proceeded for some distance between this narrow avenue of towering firs silhouetted against the blue sky like cathedral spires, till we came to open spaces in the swamp itself. Nothing could be more beautiful than these natural parterres of brilliant coloured flowers encircled by the sombre conebearers. Thousands of crimsoned Sarracenias in the centre and all around massed against the sheltering trees were the soft white clusters of Labrador Tea, *Ledum groenlandicum* Oeder. and Buckbean, *Menyanthes trifoliata* L. whose white velvety flowers against the bright satin of their leaves deserve a worthier name; this plant is no less interesting in the autumn when we find its many round

capsules filled with smooth shining amber seeds. Lying deep in the cool sphagnum we discovered the pale yellow flowers of the little Coral-root, *Corallorrhiza trifida* Chatelain and the nodding rose-coloured blossoms of *Vaccinium Oxycoccus* L., with its delicate foliage wandering about everywhere between the pitcher-plants, most capriciously and fancifully. The silky tassels of the Cotton Grass, *Eriophorum viridi-carinatum* (Engelm.) Fernald., waved above the blue flags and tall spikes of the green orchid, *Habenaria hyperborea* (L.) R. Br. and stirred the lightly poised petals of the Lady's Slippers. I found five different species of these last named exquisite orchids in this one swamp: the large yellow Lady's Slipper, *C. parviflorum* Salisb. var. *pubescens* (Willd.) Knight; the smaller one, sweet scented with rich madder-brown sepals behind the yellow lip; the pink stemless, *C. acaule* Ait., looking pale in its unaccustomed damp surroundings; the Ram's Head Lady's Slipper, *C. arientinum* R. Br., and the Showy Lady's Slipper, *C. hirsutum* Mill. These last lovely orchids were growing in great quantity, even more abundantly than the pitcher plants, but we were too early for them, there were not more than half-a-dozen in bloom. The 22nd of June, or a little later, is the best time to see them.

At the side of the path leading into one of the most enticing of these open spaces, there is a stump of a tree, covered with charming mosses and lichens, which our guide proudly designated as the "Lady Grey Stump." Lady Grey paid a visit to the swamp when the Showy Lady's Slippers were in full bloom, and she sat here to rest in the midst of thousands of these beautiful pink and white orchids.

BOOK NOTICE.

WATER-POWERS OF CANADA.—The first inventory ever taken of the water-powers of Canada has been completed by the Commission of Conservation and the results embodied in a large and profusely illustrated report just issued. The investigation made by the Commission, which has extended over a period of two years, shows that there are 1,016,521 horse-power developed from water-power in Canada. Every phase of the subject from the laws governing the disposition of water-powers in the various provinces, to the actual physical data regarding each individual water-power concerning which information was obtainable, is treated in the report. In addition, there is a very full bibliography of 30 pages, and appendices giving, among other things, the text of the laws concerning the export of power and also of the treaty recently concluded with the

United States regarding the establishment of an International Joint Commission.

The volume opens with two chapters of an introductory nature that are concerned mainly with the general economic bearing of water-powers on national development. The relation of water to agriculture, mining, navigation, domestic supply and so forth, is dealt with, and the principles to be used in the interpretation of water-powers data are stated and discussed critically. The broad and optimistic statements very often made on the platform and in the press regarding our vast water-power resources are deprecated. To quote from the Report, "General statements implying that the aggregate amount of water-power must be great because the total water area, or watershed area is so great, or because there are so many lakes and rivers, are generalities to be considered of very little definite value. . . . One of the chief dangers of such generalities is to create in the popular mind a feeling of unwarranted assurance that, even though desirable water-rights are being granted by a government, yet there is so much left, that no apprehension may be entertained regarding the amount of power rights being parted with."

A chapter is devoted to the water-powers of each province in which the general features of the province as regards water-power development are discussed and an outline given of the law whereby powers are granted or leased to private individuals or corporations. The larger developments are also described. The statistical data given in tabular form includes the height of the fall, the horse-power that may be developed, the present development and the main uses to which the power is applied such as lighting, pulp and paper making, etc. Reference is also made to the possibility of increasing the amount of power developed by storage reservoirs and dams where such are feasible.

The power situation in Ontario is treated very fully, special attention being given to the power possibilities at Niagara and the conditions affecting development there. Each of the power companies operating there, whether on the Canadian or American side, is described in detail. A significant reference is made to the granting of franchises to develop power at Niagara Falls. The Report states that the low-water flow of the Niagara river would yield at the Falls, about 2,250,000 H.P., of which Canada's share (one-half), would be 1,125,000 H.P. "Franchises have already been granted," it goes on to say, "and plants partially completed, for the development on the Canadian side of the river, of about 450,000 H.P. In other words, instead of 'millions' of horse-power being available, as has been sometimes stated, it appears that about half, and by all odds the better half, of Canada's usable share of Niagara Falls power has already been placed under private control."

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May, 1912

No. 2

A FOSSIL STARFISH WITH AMBULACRAL COVERING PLATES.

BY GEORGE H. HUDSON.
(Plates I-III, fifteen figures.)

Through the courtesy of Dr. Percy E. Raymond my attention was recently called to a very remarkable sea-star found at Ottawa, Canada. Mr. J. E. Narraway, the discoverer of the form, kindly allowed me to keep it through Dec., 1911. and Jan., 1912, for photographic work and study. During this period I made a series of forty-five different photomicrographic negatives of the specimen showing the whole or portions thereof under different conditions of light, angle, or mounting and at various stages of a partial development which was given the arms and oral cavity. Prints from fourteen of these negatives were selected for use in making the figures for the plates accompanying this article. Figures 1 and 2, plate I; 2, 5 and 7, plate II; and 1, 2, and 3, plate III, were made under a gum dammar mounting with coverglass. For a description of this process and some remarks concerning its value see "New York State Museum Report 149," page 218.

Figure 3 of plate I represents the specimen near the beginning of my work upon it. Lines drawn down the radii reveal two distinct centres. The elongation of the oral aperture along the line connecting these centres, the elongation of the disc itself in the same direction, the widening of the lower interradius of the figure and the narrowing of the next interradius at the right and at the left have been interpreted as indicating the position of the posterior interradius and the figure has been so oriented and marked. Figure 1 of this plate shows the condition of the specimen at the end of such development as I felt justified in making.

ELEMENTS OF THE SPECIMEN AND TERMINOLOGY.

The bordering plates will be called *marginals*; the large single marginals of the interradii will be designated as *inter-radial marginals* and the remaining marginals as *arm marginals*.

The single small interradi al ossicle which rests against the orad face of each interradi al marginal will be considered as an *oral*. The rows of ossicles which lie against the ambulacral faces of the marginals and orals will be called *adambulacrals* and considered as strictly homologous with the plates in a similar position in all species of Palaeaster. They bear true covering plates or *epineurals* as do the flooring plates in the Edriasteroidea and this terminology will therefore also correspond with that used by Bather in that class. The single interradi al plate placed orad of each adambulacral jaw (plate III, figs. 3 and 4, interradius 3), will for the present be considered as homologous with the torus angularis of the Ophiuroidea and called simply the *torus*?. Immediately exterior to these ossicles and resting on each adambulacral or *primary jaw* we find a pair of plates which will be designated as *secondary jaws*. Exterior to these again we find a pair of plates resting against the orad faces of the interradi al marginals (plate III, fig. 3, interradius 3). These plates we shall call the *first epineurals*. So far as now known the specimen shows no other ossicles save the impression of a distinct *terminal* on radius IV (plate I, figs. 1 and 2). The arm marginals, adambulacrals and epineurals have been in part numbered on some of the figures presenting them.

The marginals of this species are so characteristic that one should be able to recognise its presence by them alone. Particularly should this be true of the large interradi al marginals. A study of the form of the ridges and depressions on the oral faces of the latter and of their outlines when viewed as in plate III, figs. 1 and 3, or as in plate II, fig. 4, should give enough detail for determination.

Resting in part on the first epineurals of interradius 4 (plate III, fig. 3), there is a large plate that, with one or two others, was thrust over the specimen, after its death, from the fourth interradius. This movement thrust the third epineural of the lower row in this figure over against its fellow of the opposite row, caught it by one of its aborad edges and turned it on its long axis through a little more than ninety degrees. It was also the cause of slight displacement of four first epineurals and perhaps also, through plates now lost by weathering, of the displacement of the secondary jaw of the first interradius and the removal of other epineurals in advance of the moving mass. This large foreign plate possesses the same dimensions, the same curve of the convex distal end, the two slightly concave portions of the margin following this on either side and the broader, thicker orad end of an interradi al marginal of this species. It was exposed to the effects of weathering before the other plates in its vicinity and has apparently lost a portion of

its oral end by separation of weathered cleavage planes of the calcite. In spite of the losses it has received it still appears to be an interradial marginal of this species but belonging to another specimen.

A search for ambulacrals was made along the grooves left between the adambulacrals in the older portion of the arms. The weathering of the material filling these grooves had left a fine residual sand which could be easily removed. The groove of arm I was excavated to considerable depth (compare figures 1 and 3 of plate I), but no trace of any plates lying between the adambulacrals could be discovered.

That the arms had no true stelleroid ambulacrals and also no ossicles on their aboral surfaces is unmistakably suggested by two cross sections of the arms shown in plate II. Figure 5 is of ray V at the aboral surfaces of the second arm marginals. The rest of the arm had been here lost and the blackened carbonized bed on which the arm rested could be easily removed. The excavation was continued below the very definite line between the blackened bed and the lighter colored limestone of the matrix. After cutting down to a greater depth than that of the marginals themselves a bit of cover glass was placed on edge and allowed to rest against the faces of the marginals. The transparent liquid gum was then gradually filled in back of the glass and the photomicrograph taken from a position as near the horizontal as the specimen could be placed before the objective of the microscope. The blackened porous bed is seen to be attached to the outer edge of the marginals and to strike diagonally across the interradial spaces both to the right and to the left (interradii 4 and 5). No trace of any aboral plates is here revealed and ambulacrals are also wanting.

Figure 7 of plate II represents a cross section of arm III at the aboral surfaces of the sixth pair of arm marginals. The cut here under the lost portion of the arm was made to a still greater depth but sloping away from the arm plates in order to avoid accidental loss as these plates are very delicately attached to the bed. The lower edge of the circular covering glass is here seen and shows the depth of the excavation. The adambulacrals are almost in contact with each other. Again there is neither trace of ambulacrals or of aboral plates. The blackened porous bed is however still present.

In plate III, fig. 5, what is apparently the broken edge of the remains of a thick leathery integument is seen to run from arm IV across the interradius to arm III. Figure 3 of plate I shows that the remains of this integument blackened all the interradial spaces and followed the more distal borders of each

arm. Before figure 1 of this plate had been made much of this blackened bed had been removed from the interradii 1 and 2 in order to photograph the arms from the side.

The specimen is so perfectly preserved and so free from distortion that we are not warranted in supposing that any large portion of the oral surface could be lost. The thick blackened layer is so loosely constructed and filled with minute flakes or grains of calcite (although these or many of them may be due to subsequent infiltration and crystallization) that we are obliged to interpret it as the remains of a thick leathery integument reminding us of the muscular integument of the *Holthuroidea* or more properly of the aboral integument of most of the *Streptophiuræ* and of the *Cladophiuræ*.

Further development may yet reveal traces of the radials and perhaps genitals but this should be undertaken only by some person whose knowledge of both the *Asteroidea* and *Ophiuroidea* is extensive, whose authority would be unquestioned and whose skill would be adequate for the task. Very valuable evidence might easily be destroyed and lost forever. It is possible that the plate here called "torus," belongs to an aboral circlet. Interradius 1 with its pieces composing the secondary jaw displaced and showing that they were not fixed to either the "torus?" or the first pair of adambulacrals but were bound to each other, should be left as it is. Interradius 2, with the secondary jaw in normal position, and interradius 3, with its first epineurals but slightly displaced, should also be left as they are. Interradius 5 should have the secondary jaw carefully removed to see if the "torus?" really rested against the oral ends of the adambulacrals and to fully reveal the oral aspect of the latter. Search should also be made for the madreporite of this species.

TAXONOMY.

There is enough now clearly shown by this specimen to make it very manifest that we are dealing with an unrecognized and very archaic morphological type which links the *Edrioasteroidea* with the *Stelleroidea*. Were it not for evidence I have yet to present as to habit, I should unquestioningly place this specimen with the *Edrioasteroidea* for it is almost as simple in its elements as *Cystaster*, Hall. On account of its stelleroid habit and the fact that we have described *Stelleroidea* which are closely related to it I feel that it should be retained in the latter class. In either case the type should be recognized.

EOSTELLEROIDAE, ORD. NOV.

This order is proposed for those *Stelleroidea* in which true ambulacrals (in the sense in which the term is used in this class)

have not yet been developed. Ambulacral pores in a single linear series and occurring at the points of contact of four adambulacra, or in a double row and placed between the adambulacra of a series.

It is in one sense unfortunate that our efforts in taxonomy all lie in the direction of *separation*. Generalized types or "missing links" must never be allowed to remain on border territory where their true relationships might be manifest to the uninitiated. This newly described sea-star seems likely to give taxonomists as much trouble as do some of the chlorophyll bearing flagellates. It is really an ancestral stellerid yet wearing the garb of the Edrioasteroidea. If we consider it a true member of the Edrioasteroidea we must recognize it as an "insurgent," for it lived the life of a stellerid and became one of the founders of that class.

PROTOPALAEASTERIDAE, FAM. NOV.

Eostelleroidae in which the marginals are large. Adambulacra opposite, the interradial pairs meeting to form a primary jaw. Ambulacral pores in a single linear series. Arm epineurals long and stout and assisting in locomotion. Disc epineurals specialized to hold and crush shelled organisms and press food toward the oral aperture.

PROTOPALAEASTER, GEN. NOV.

Protopalæasteridae with single, very large interradial marginals. Arm marginals somewhat cubical and about twice as long as the adambulacral ossicles of the same region. Original peristomial covering pieces forming secondary jaws which slide over the faces of the primary jaws. First epineurals advanced orad to close together over the secondary jaws but not capable of completely closing the space over the mouth. The following new species is designated as the genoholotype.

PROTOPALAEASTER NARRAWAYI, SP. NOV.

Interradial marginals pear-shaped, the broad end set orad, length 2.25 mm. or nearly one-third of the diameter of the disc, greatest breadth 1.95 mm.; oral face smooth, convex (plate II, fig. 4), bearing characteristic plate impressions and muscle fields:—arm marginals cuboid, oral surfaces smooth, flat and inclined aborad about 5° from the oral plane, transverse diameter equal to about one-third that of the ray:—outer faces (adambulacral) of marginals strongly convex and ornamented with small, closely and alternately set mammillary tubercles having a diameter of about 0.1 mm. each (plate II, fig. 4). The inner (ambulacral) faces are set in a straight line which makes an angle of about four degrees with the axis of a ray. The rate of transverse thickening during growth determines the form of

the outer border of the arms. In the new plates, near the ends of the arms, thickening in this direction is at first rapid. A straight line connecting the outer border of the fifth and seventh marginals makes an angle of sixteen degrees with the axis of the ray. The rate of widening is not so rapid during the later period of growth and a line connecting the outer borders of the second and fourth arm marginals makes an angle of only eight degrees with the axis. Function has demanded a greater growth of the first arm marginal and particularly of the side next the interradiar marginal. The face against the latter is 1.3 mm. long while its distal face measures but 0.8 mm. This increase of growth near the disc has thrown the marginal line rapidly outward and it swings across the distal end of the interradiar marginal in a broad, hyperbolic curve. The outer edges of each arm thus present a very gentle sigmoid "line of beauty." The extension of the arm is nearly equal to the diameter of the disc. Disc radius about 4.4 mm., arm terminal 11.6 mm. from disc centre. The species can be easily determined from its marginals alone. More detailed descriptions of the other ossicles will be given later.

The specimen was collected by Mr. J. E. Narraway from the lower part of the Black River limestone on the top of a small hill a few rods west of the City View Post Office and is now in his private collection. It was lying in its bed with oral face uppermost. I have named the specimen after Mr. Narraway in slight appreciation of the debt due him for the discovery of such a remarkable type.

In a following portion of this paper I shall deal specifically with habit and adaptation as revealed by the skeletal elements preserved.

VARIATION IN PLANT LIFE, ITS BIOLOGICAL SIGNIFICANCE AND PRACTICAL VALUE.*

All evolution, be it evolution of humanity from a lower to a higher level, or the evolution of the animal or vegetable kingdom from primary types to more perfect ones, is based upon two principles, the principle of heredity and the principle of variation.

*Synopsis of lecture delivered before the Ottawa Field-Naturalists' Club, February 13th, 1912, by Dr. M. O. Malte, Dominion Seed Branch, Ottawa.

Unfortunately, the term "variation" has been applied to a great number of phenomena of a very different nature, and in the mind of most people is something that can not be clearly defined. As a result, the biological and practical significance of variation is not clearly appreciated.

1. The individual plants of a species sometimes present such striking differences at different stages of development that the observer might readily regard them as different species or even different genera, where, as a matter of fact, only different ages are represented. Thus, a great number of species of the genus *Acacia* present a delicate fern-like foliage when young, whereas the old plants are clothed with narrow and simple leathery organs, which in shape and texture resemble the leaves of the mistletoe. Conifers, such as *Thuja* and *Juniperus*, which when fully developed have flat, scale-like leaves, are when seedlings provided with typical needle-leaves. Such juvenile forms can be fixed by cuttings and they then keep their peculiar needle-leaves for many years, presenting small trees, which are no more like the *Thuja* or *Juniperus* than a spruce is like a pine tree. Such fixed, juvenile forms have been described as species of a special genus, *Retinospora*.

2. Light sometimes causes variations of the most astonishing nature. The well-known blue bell, *Campanula rotundifolia*, generally has only long, narrow leaves. When the plants are growing in grass, however, or when they are young, basal leaves occur, which are round or kidney-shaped. Whether or not a plant shall have the latter kind of leaves is a matter of light, as can be demonstrated by the following experiment: enclose the upper part of a blue bell plant in a box of wood, and the new shoots developed from the enclosed parts of the plant will carry leaves round or kidney-shaped and in all respects similar to the round or kidney-shaped root-leaves.

3. Amphibious plants often present one water-form and one land-form, which are widely different from each other. Numerous experiments have shown that the water-form can be changed into the land-form and vice versa, and that the same individual can present shoots of both types at the same time. Such variation, induced by the amount of water available, can be observed in such plants as water parsnip (*Sium*), water plantain (*Alisma Plantago*), knot-weed (*Polygonum amphibium*), numerous species of *Ranunculus*, etc.

4. Other plants, when placed in certain environments, often show striking variations. Thus, it is rather common for plants growing in a climate where hot winds prevail, such as in

deserts, to have a heavy coat of gray or white woolly hairs. In some cases it has been actually proven that the production of the woolly hairs is directly induced by the hot climate and that plants covered with dense hairs will drop these if transplanted into a climate of greater humidity.

The important influence upon the general configuration of plants exercised by the environmental conditions leads naturally to the practical question: "Is it possible to produce, by changing the climatic conditions, new types or new plant species?" If a species is defined as a unit, provided with certain *constant* characters, we must answer that, as far as our experience shows, it is not possible to produce new plant species by changing the outer conditions; no facts exist to support the opinion of Lamarck as to the hereditary quality of acquired characters in plants.

The aforesaid variations are all produced by the influence of different external factors upon individuals. When speaking of "variations" in ordinary parlance, however, we usually think of something quite different. We speak of the great variation in roses and apples, by which we mean that there occur a great number of types in apples and roses. The forms which generally are termed individual variations do not refer to the changing of a certain type or a certain individual, but simply to the existence of types possessing different characters. When speaking of "variation" people have been inclined to associate with the term the idea that something is changing. When speaking of individual variation within a species they ordinarily assume that a given individual can become permanently altered in character in one direction or another, that, in fact, a certain main type can produce a number of different, constant varieties. Such a conception, however, leads to confusion and to a misinterpretation of the phenomena connected with the species idea and the proper idea of variation.

When we speak of the apple species, for instance, we must remember that the word species is only an abstract which we use for all kinds of apples. And when we say that this species or that species is very variable, we simply mean that it consists of a number of distinct types.

The practical importance of "individual variation" in a plant species is now clear. It simply means that nature herself has provided for a great number of concrete types which, from a practical point of view, are of very different value. And, when we say that we use the individual variation of a species for practical purpose, we really mean that we use the life-types or bio-types of the species in question.

THE EVOLUTION OF THE WORLDS.*

By J. S. PLASKETT, B.A., F.R.S.C., THE OBSERVATORY, OTTAWA.

I have felt considerable difficulty in preparing a suitable paper for presentation to the Ottawa Field-Naturalists' Club. The connection between natural history and astronomy is so slight that no subject was known to me, forming a sufficient connecting link between the two sciences, to base a paper upon. It was only upon learning that it was not essential for the paper to have any direct relation with the natural sciences that I undertook to prepare it. Although it is almost entirely astronomical in character yet the title suggests some analogy to one of the most important developments in your science, that of evolution. I hope to be able to trace for you, if only in an imperfect way, how the development of the celestial universe has taken place, and I think we will find as we go along, that there is in some respects considerable similarity in the scheme of evolution in the two sciences.

Although we, in our feeble way, can trace the process of development from the original primal material in its simplest forms to the very complex manifestations that we see all around us, both on the earth and in the heavens, and can see that this development in both sciences has followed by the operations of laws, which, simple in themselves, are yet so perfect and complete and far reaching as to excite our admiration and awe, yet we have in the very beginning to start with the Creator. Surely there is not one of us but feels that such a plan of creation as is here implied requires a higher, wider, and nobler conception of the Almighty Ruler of the Universe than the one which imagines it to have been made, as it were, in a moment.

It is only within comparatively recent years that we have been able to enunciate any definite theories in regard to the constitution and mode of formation of the universe and its component parts, in which is included, as a very insignificant portion, our own solar system. Undoubtedly the one discovery leading to this advance was that of the principles of spectrum analysis, first definitely enunciated by Kirchhoff in 1859. On this epoch-making discovery is based the whole science of astrophysics, sometimes called the new astronomy, which treats of the constitution of the heavenly bodies, as apart from their positions and motions in the celestial sphere, which is the province of the older astronomy, or astrometry as it is now sometimes called.

*A Lecture given before the Ottawa Field-Naturalists' Club, 27th February, 1912.

As many of our deductions will be based on the facts ascertained by the spectroscope, it may be as well to briefly explain its principles. The spectroscope has, in its simplest form and as its essential elements, a narrow slit on which the light from the source to be analysed is thrown, a lens behind the slit, called the collimator lens, which renders the light parallel and a prism, a triangular piece of glass, which decomposes or analyses the light into its constituent colors. The spectrum, as the rainbow colored band which is formed is called, can then be examined with a telescope or photographed by a camera. I have a diagram which shows the arrangement of these parts of the instrument and I can form a spectrum on the screen.

The spectrum shown is that of the white hot carbon rods of the electric arc, which give us what is called a continuous spectrum, one in which the colors shade gradually from one to the other. Whenever you see a continuous spectrum, you know that the light source is an incandescent solid or liquid body. If we were to separate the carbon rods and burn a metal or any substance between them, we would get a spectrum of the vapor of that substance which would consist, not of a continuous band of color, but of a number of separated bright lines, distributed over the spectrum, and varying in number from about a dozen in the case of lithium to many thousands in the case of iron. Such a spectrum is called an emission or bright line spectrum and indicates, first of all, that it comes from incandescent gas or vapor, and, secondly, tells us unmistakably the element which produces it. For each element has not only a distinctive and invariable number of bright lines in its spectrum, but the positions and arrangements of these lines are always the same for the same element, and differ for different elements. When these positions are mapped for all the elements, it is evident that by examining the spectrum of any substance, no matter how complex, we can determine the elements of which it is composed. There is a third kind of spectrum called an absorption or dark line spectrum, in which the bright lines of the emission spectrum become dark lines in exactly the same positions, and it is evident that the elements producing it can be identified in exactly the same way. The absorption spectrum is produced when an incandescent source shines through gases or vapors at a lower temperature, and is the kind of spectrum given by the majority of the stars, showing that their glowing centres are surrounded by atmospheres of cooler gases.

Spectrum analysis tells us then, not only what elements any body emitting light is composed of, but also gives us information as to its physical condition, whether solid or gaseous, and whether surrounded by cooler or hotter gases. This is

equally true of celestial as of terrestrial bodies, and when the light of the sun or of a star is projected on the slit of a spectro-scope, we have at once an unfailing and accurate criterion as to the elements present in the atmosphere of the sun or star.

When we analyse the light of the sun in this way we find lines in its spectrum due to most of the terrestrial elements, and, as we have good grounds for believing that earth and sun had a common origin, we can safely assume that their composition is identical, and that, if some terrestrial elements do not show in the solar spectrum, it is either on account of their relative scarcity, or because their spectrum is weak and overpowered by others. On the other hand there is no convincing evidence of the presence in the sun of any elements not found on the earth, although this was not the case a few years ago. There is always present in the spectrum of the outer atmosphere of the sun a very bright yellow line of which there was no known terrestrial counterpart and the hypothetical gas producing this line was called helium. Sir Wm. Ramsay, in 1895, in examining the spectrum of a gas, obtained by heating a rare mineral called cleveite, found that it gave a strong line in exactly the same position as the yellow solar line and was consequently due to the same element, helium. Helium is a very light gas, does not combine with any other elements, and has not sufficient mass to enable the earth's attraction to retain it in the atmosphere. Consequently most of the helium, except that occluded by the mineral cleveite and, as we now know, that obtained from the degradation of radium had dissipated into space. This is an interesting incident, and as will be seen later a very important and widespread one—a new element discovered in the sun before being found on the earth.

Although we might possibly have reasoned from other evidence of the probable identity of composition of the sun and earth, we certainly could not, without the spectroscope, have known anything definite of the constitution and physical condition of the stars. When, however, we examine their spectra we find nearly forty per cent. of them practically identical with the sun, and the remainder shading off by gradual degrees into simpler and simpler spectra until only the lines due to hydrogen and to hydrogen and helium remain. The disappearance of the lines of the heavier elements is not, however, an indication that they are not present, but only that, owing to the higher temperature of the hydrogen and helium stars these light elements are the chief constituents of their outer atmospheres and the elements of higher atomic weight are nearer the centre.

The evidence then, spectroscopic and otherwise, of the chemical unity of all the matter in the universe is indisputable.

If the spectroscope had done nothing else than this, it would have established a far reaching and most important generalization, and one which enables us to develop a uniform and homogeneous theory of cosmical evolution, impossible without this knowledge.

If we look up at the sky on one of these brilliantly clear nights, we see stars scattered more or less irregularly over the whole hemisphere visible to us. The number visible to the unaided eye at one time is generally much overestimated, the maximum number being about 3,000 instead of millions as I have heard some people express. The great majority of these objects, as well as thousands of times as many more rendered visible by telescopic aid, are suns shining with their own intense light and heat, many of them similar to our own sun, while many are in earlier or later stages of development, and of larger or smaller size. Besides the stars and the planets, of which latter there are generally not more than two or three visible to the eye at one time, close scrutiny, and knowing where to look, will enable to detect a few objects which look like faint hazy stars but which, when viewed by the telescope, present an altogether different appearance, have a more or less extended, misty, hazy, nebulous appearance generally without sharply defined boundaries. These are what are called the nebulae, and, though not so numerous as the stars, nevertheless number many thousands throughout the sky.

When analysed by the spectroscope some of them give a continuous spectrum, indicating a source composed of luminous solid matter probably in the form of dust or small particles. Others, notably the Great Nebula in Andromeda, the largest in the sky, give an absorption spectrum similar in some respects to that of our sun, indicating a stellar origin of the light, and showing that these bodies are possibly Galaxies or Universes like our own situated at almost inconceivable distances. Many of the nebulae, the Great Nebula in Orion, the most beautiful in the sky, being a conspicuous example, give bright line or emission spectra indicating the elements hydrogen, helium and a gas unknown on the earth which, for want of a better name, we call nebulium. Considerable speculation has been indulged in as to the nature of nebulium which is generally considered to be a very simple form of matter. Only last month a paper appeared in the Monthly Notices of the Royal Astronomical Society by Dr. J. W. Nicholson which assumed the atom of nebulium to be of the nature of a positive charge of electricity surrounded by a revolving ring of negative ions three or more in number. Calculating mathematically the wave lengths of the lines given by such a system they were found to agree quite

closely in position with the unknown bright lines in the nebular spectrum. We seem to be, with all the recent developments in radio-activity and the ultimate constitution of matter, on the eve of most important discoveries and generalizations not only in astronomy but in its sister sciences, physics and chemistry. Notwithstanding the diversity of composition indicated, it is believed that all these bodies contain the same elements, our terrestrial substances, and that only the spectra of the elements appear which are most easily produced by the particular forms of energy in action. It is not probable that the luminosity is produced by heat, for the enormously extended and attenuated matter of the nebulae must be at a very low temperature; it is rather a sort of luminescence, perhaps due to electrical action or to some form of radio-activity.

We have in the nebulae, according to the practically universal belief of scientific men, the primal form of matter, the material from which suns and worlds are made. From this world stuff, if I may use the term, we can trace the evolution, following simple and well known laws, to suns and stars in all their stages, to planets, comets and all the heavenly host. Further than this also, though this is the province more particularly of your science, following also other simple and well known laws, the gradual development of life on planets such as ours from the lower to the higher forms can equally well be traced.

In the tracing of this evolution in the heavens, it must not be for a moment supposed that it can be followed in any one star, any more than that the changes in living organisms can be detected in one generation. Stellar development is so inconceivably slow that it is very doubtful whether any change could be detected in a million years. But we have in the sky so rich a field for observation, such a great number of stars in all stages of their development, that by the aid of the spectroscope and by data obtained in numerous other ways it is possible to arrange in orderly sequence the process of evolution. If we suppose ourselves in an oak forest, though we could not expect to see the growth of any one oak from the acorn and seedling through small and large to a fully developed tree, and then through the process of decay to a crumbling log, yet we would have no difficulty, owing to the examples in all stages of growth around us, in correctly tracing and arranging the development.

Let us begin then with our nebula, whether gaseous or of finely divided particles does not matter, as, by the theory of the chemical unity of the cosmos, there are all the terrestrial elements present or perhaps, to be more precise, at least matter out of which all terrestrial elements may appear. It is practically certain that this matter is extremely attenuated or

thinly scattered over enormous spaces, hundreds, thousands, aye, in many cases, probably millions of times the extent of our solar system, and is certainly much less dense than the highest vacuum we can obtain upon the earth. Notwithstanding its tenuity, it is not exempt from the universal law of gravitation, by which every particle of matter of every kind, in all places and under all conditions, so far as we know, attracts and is attracted by every other particle of matter by a force which is directly proportional to the product of the masses of the particles, and inversely proportional to the square of the distance between them. The law of gravitation with which you are all familiar was first enunciated by Newton and has been proved, not only for all matter upon the earth, but all the motions of the heavenly bodies as well as their development are governed by this law with the most marvellous exactitude. You can at once see what will happen when all the particles, whether solid or gaseous, of our nebula are acted on by this force, each pulling the other. Mathematical demonstration proves, what is indeed almost evident from common sense principles, that the resultant pull on each particle will be towards the centre of the mass, and this pull, although almost infinitesimally small in the originally attenuated material, will tend to condense the nebula.

(Continued in next issue.)

POISON IVY.

BY CHARLES MACNAMARA, ARNPRIOR, ONT.

Before reading Mr. Gussow's interesting note in the Oct.-Nov., 1911, number of THE OTTAWA NATURALIST, few people, I imagine, were aware of the existence of so many different kinds of skin-poisoning plants. To the list of indigenous plants of this class which Mr. Gussow mentions, I would add, though somewhat doubtfully, the prickly ash (*Zanthoxylum americanum*). For while no botanical work to which I have access attributes any poisonous properties to this plant, I know of two cases of severe skin irritation that could not easily be traced to any other cause.

But by far the most dangerous of all our toxic flora is the poison ivy (*Rhus Toxicodendron*). It is one of the commonest and most widely distributed plants in this part of Canada, and seems to thrive in almost any environment. A few years ago I noticed large quantities of it growing luxuriantly on the barren rock just below the Citadel at Quebec, and it is frequently found

in dry woods and along road-sides all over the country. But perhaps its favorite habitats are the edges of swamps and in damp, shady places. In such situations it grows remarkably large, its leaflets sometimes attaining the size of a man's hand. It is often described in books as a "climbing shrub" or spoken of as a "vine," and sometimes it does clamber over stones or hoist itself a few feet up a tree trunk by means of its rootlets, but in this district at least the shrubby, erect form is much the commonest, and the plant is seldom found climbing. This is an important point, for those unacquainted with the plant on finding it described as a vine or a climber, naturally fail to identify the low growing erect form as the true poison ivy. Some botanists distinguish the climbing form as a "variety" and give it the cognomen "*radicans*," but both forms seem to be merely different habits of the same species.

In a recent book, Sir Ray Lankster notes several unaccountable cases of severe dermatitis that occurred in England a year or two ago, and which were finally traced to *Rhus Toxicodendron* that had been sold by nurserymen, innocently enough no doubt, instead of a kind of Virginia Creeper (*Ampelopsis Veitchii*) which the *Rhus* resembles rather closely. Such ignorance of the poison ivy is not, of course, at all surprising in Europe, where the plant is not indigenous; but in this country, if only as a matter of self-protection, everyone should be able to recognize the ominous triple leaf, and it is remarkable to discover how many people are not acquainted with it. I have seen it, when colored red in the late summer, occupying an honored place in a bouquet of wild flowers gathered by an unsuspecting camper. It is true that in the fall when the sap is drying up, it is not as dangerous as in the summer when it is lush and green, but it is an exceedingly risky thing to handle at any time.

The poisonous principle is a fixed oil which is found in all parts of the plant, and persists in the dead leaves and the wood, even after long drying. Minute dust-like particles of the plant carry it, and very slight traces of it on the clothing may cause an attack in those susceptible. The pollen blown by the wind doubtless accounts for those mysterious and not infrequent cases that occur where no actual contact with the plant has taken place. This oil has no apparent effect on animals, and it is even said that the horse, mule and goat eat the leaves with impunity and that birds feed upon the seeds. Like other oils, it is insoluble in water alone, but may be readily washed off with soap and water, and is quite soluble in alcohol. From experiments made some years ago by Mr. V. K. Chestnut, of the United States Department of Agriculture, it appears that its effect on the skin is by no means instantaneous, and if washed

off within about an hour of its first contact, no ill results ensue, unless, perhaps, if one is very susceptible; and, as is well known, individuals differ vastly as regards susceptibility. Some people contract the disease in a more or less severe form regularly every summer; others appear to be quite unaffected. And, after all, the large majority are practically immune. For, when one considers the wide distribution and great profusion of the plant, it is evident that only a comparatively small percentage of those who come within its evil sphere of influence are poisoned by it. At the same time it is very doubtful to my mind if any one is *perfectly* immune. Given certain favorable, or rather unfavorable conditions, particularly heat and moisture, and no one is safe from the attack. A friend of mine, a lumberman, who has spent all his life in the woods, and must have been continually exposed to the infection ever since his boyhood, was a few years ago badly poisoned for the first and only time in his life. One damp warm day in June he had occasion to walk some distance through a bush infested with poison ivy just when the latter was in bloom. In slapping at the mosquitoes, which were very troublesome, he doubtless transferred the acrid oil from the leaves or pollen to his face. For a day or two after he suffered a very severe attack which completely closed up his eyes. I was myself for years under the impression that I was quite immune, and often handled the plant with impunity, until one day I inadvertently dropped my cap into a clump that was in blossom. The pollen evidently shook off into the cap and thus came into contact with my skin, for a day or two later the familiar vesicular sore broke out across my forehead. Annual recurrences of attacks without any fresh exposure to the infection are occasionally reported. Some of these may safely be referred to traces of oil remaining on summer clothing that is resumed the next year; but, there are others that are not so easily accounted for. I have been told of an attack first contracted by stepping on the plant with a wet and naked foot, which recurred regularly, without new infection, every year for seven years. That mystic number "seven" might cast a shade of suspicion, if I had not the fullest confidence in the accuracy of my informant, who is an expert botanist and a scientific observer, and who had personal knowledge of the occurrence. If, as seemed to be shown by some of Mr. Chestnut's experiments mentioned above, the irritation is purely local and external, it is exceedingly difficult to account for such attacks, and the only explanation I can offer, and that very tentatively is that they are the result of autosuggestion. But here we plunge into physiological psychology, and if I want to keep within my depth I had better stop.

Alleged remedies are numerous. Most of them owe their

reputation to the fact that they have been used just as the disease was abating naturally, and straightway they got credit for a miraculous cure. A trapper of my acquaintance assured me that a fresh poultice of jewelweed (*Impatiens fulva*) was a sovereign remedy, but a personal trial failed to prove his assertion. I have heard of an infusion of *Antennaria* (species not stated) having been used with success, and a ten per cent. solution of sodium hyposulphite is sometimes prescribed, but there is really no specific known for the disease, and the most effective remedy only shortens the period of the attack. My friend, Dr. Graham Harkness, of Vineland, Ont., who is himself very susceptible to the poison, and consequently has had a great deal of experience in its treatment, has kindly given me the following notes on the therapeutics of the subject:—

“If a susceptible person finds that he has exposed himself to poison ivy, he should, as soon as possible, wash thoroughly in warm water and castile soap, and then apply a dilute solution of ammonia. This will often prevent an attack.

An attack untreated will run its course in about 18 days. Properly treated it will subside in a week or 10 days.

For small patches scrub thoroughly with a stiff brush, or if on the face, run over them with a safety razor, and apply alcohol. This treatment is somewhat painful, but causes the spots to dry up and disappear in 4 or 5 days, and besides it absolutely relieves the itching.

For a more generalized attack nothing is better than the old-fashioned lead and opium lotion: one teaspoonful each of lead acetate and laudanum to 4 oz. of water.

The principle of all treatment is the same: apply astringents. The more effectively this can be done the quicker the cure.

For the unhealthy condition in which the skin is often left after an attack, nothing is so good as arsenic in the form of Fowler's Solution, 2-5 drops in water three times a day.”

But here the proverbial ounce of prevention may well be quoted a good deal above par, and the moral is, even if you are quite sure that you are immune, have no unnecessary commerce with poison ivy.

BOOK NOTICES.

THE EVOLUTION OF THE VERTEBRATES AND THEIR KIN, by William Patten, Ph.D.; P. Blakiston's Son & Co.: Philadelphia: price \$4.50.

In this volume of nearly 500 pages, Dr. Patten has given us the result of a quarter of a century's effort towards the solution

of one of the most fascinating and certainly one of the most difficult problems in the field of zoology.

Dr. Patten's paper, "On the Origin of Vertebrates from Arachnids" appeared in 1890; since then he has published many admirable studies in morphology, many of which have dealt with sections of the larger problem that has occupied his mind for so many years.

In presenting the arguments in support of his well-known "Arachnid Theory," the author covers a very large morphologic field and offers an immense amount of valuable material, concisely and clearly presented. The summary at the close of the chapters is an excellent feature. There are 309 very fine illustrations, many diagrammatic and all of them instructive. The relegation of the "Explanation of the Lettering" to the close of the volume saves much space, but is rather inconvenient to the reader.

At the close of the last chapter the work of the comparative morphologist is earnestly impressed.

"Hence, comparative morphology and phylogeny must always constitute the fountain head whence comes our knowledge of creative evolution. Such problems as the phylogeny of vertebrates are, therefore, the most important ones the biologist has to deal with, for on their solution depends our conception of the way in which evolution actually has taken place.

The cytologist is too intent on the raw material of life; his field of operation is both too remote and too narrow to give either measurable detail or perspective. To discover the immediate causes of any given stage in the evolution of the nervous system or of the endocranium, by a study of chromosomes, or of protoplasm, or by juggling with imaginary hereditary units is as hopeless a task as it would be for the geologist to explain the delta of the Ganges by an appeal to the composition of cosmic matter.

The naturalist is bewildered by the amazing detail of the finished product, and so much absorbed in the social organization of the present moment, or in the relation of one plant, or animal to the other, and to the environment at large, that he fails to acquire an adequate historic perspective.

The experimental evolutionist, for a few hours, or months, arbitrarily narrows the environment of an organism and measures the results, if any, with instruments of precision, or with the aid of higher mathematics; but he generally ignores or looks with contempt on the vast experiments already performed for him, where the laboratory is nature, and the results are expressed in species, genera and classes.

The comparative morphologist aims, not merely to trace

the identity of changing structures under the disguise of new forms, but to measure the rate of these changes, and to seek out the underlying causes that have brought them about. He is heavily handicapped by the lack of materials that can be precisely measured or controlled. But on the other hand there is a certain advantage inherent in the very size and remoteness of his problems, that is absent in the brief laboratory experiments that have taken place under the eye of man. His problems must be viewed from a great distance, but one that gives a large perspective, and draws a vast range of structural changes into a single horizon where sporadic details disappear, and only those events catch the eye that are massed around some central cause or are ranged with monotonous regularity along some common line of physiological upheaval."

Whether or not the reader accepts all the author's conclusions, there can be only the greatest admiration for the work that has preceded the writing of this important book, as well as for the marked ability with which the arachnid theory is presented. The work is a masterpiece, and marks an important step in the progress of zoology.

The publishers, P. Blakiston's Son & Co., are to be complimented upon the excellent get-up of the volume. The press work is very fine.—J. M. S.

A HISTORY OF THE BIRDS OF COLORADO, by William Lutley Sclater, M.A. (Oxon.), M.B.O.U., Hon. M.A.O.U., (lately Director of the Colorado College Museum), with seventeen plates and a map; Witherby & Co., 326 High Holborn, London; price \$5.00.

This new volume of 576 pages is founded upon the very complete collection of Colorado birds formed, during the last thirty-five years, by Mr. Charles E. Aiken, of Colorado Springs. The number of Colorado birds included is 392, and of these 225 are considered as regular breeders within the State. The nomenclature and classification used are almost without exception that of the recently published third edition of the A. O. U. check list.

Under each species is given references to Colorado Records, Descriptions of the Adults, Distribution and Habits, which latter includes nesting habits with an account of the eggs. Pages 533 to 551 are devoted to a Bibliography which includes references to all articles on Colorado ornithology of importance, up to December, 1910.

Students of birds generally will welcome this important contribution to American ornithology. There is no apology necessary for the appearance of this additional bird treatise.

The author points out that the published work of Cooke is now out of print and difficult to obtain. This new book, in addition to the description of the birds, etc., gives keys by which the birds observed, or obtained, may be determined.

The plates are beautiful reproductions from photographs taken from nature, and add much to the interest and value of the volume. The printing and arrangement of the text, etc., are excellent, and the author and publishers alike are to be congratulated.—A. G.

In that valuable series of little books, the "Cambridge Manuals of Literature and Science," there are some numbers that may appeal in particular to readers of THE OTTAWA NATURALIST. The following have been added to the Carnegie Library, Ottawa:—

1. "Heredity in the Light of Recent Research," by Doncaster; a useful little book, giving outlines of the theories of DeVries and Mendel, and of the work of Bateson.
2. "Plant-animals," by Keeble; based on researches carried on for some years in a marine laboratory in Brittany—really a study of the life-history and habits of two marine worms, the green plant-animal and the brown plant-animal.
3. "Prehistoric Man," by Duckworth; an account with illustrations of various human remains of great antiquity, with brief mention of theories based thereon, and an attempt to arrange the primitive types in ascending order.
4. "Links with the Past in the Plant World," by Seward; an enquiry into the relative antiquity of existing plants, with reference to the evidence afforded by fossils—deals chiefly with ferns and coniferæ.
5. "The Migration of Birds," by T. A. Coward; titles of chapters are: Cause and Origin of Migration, Routes, Height and Speed of Flight, Route Finding, Distances Travelled, Perils.
6. "Plant-life on Land," by F. O. Bower; a series of short essays to illustrate the migration of plants originally aquatic, to the land, and their adaption to their atmospheric surroundings—shows the point of view of the present day botanist.
7. "The Natural History of Clay," by Searle: some topics are: clay and associated rocks, origins of clays, some clays of commercial importance.
8. "Earthworms and Their Allies," by Beddard.
9. "The Coming of Evolution," by Judd.
10. "The Natural History of Coal," by Arber.

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Nos. 3 and 4

ON TWO NEW CRINOIDS FROM THE TRENTON FORMATION OF ONTARIO.

(Plate IV, Figures 1-4).

By W. A. PARKS AND F. J. ALCOCK, UNIVERSITY OF TORONTO.

In his recent memoir on Trenton Echinoderms prepared for the Geological Survey of Canada, Mr. Frank Springer refers to a specimen in the museum of the University of Toronto as a new species of *Carabocrinus*.* This opinion was expressed in confirmation of a diagnosis by the writers which was based on the character of the arms alone. A careful cleaning of the specimen has revealed the cup in a fair state of preservation but insufficiently perfect to warrant conclusions as to certain of the plates. Despite this imperfection, it is highly probable that the specimen represents a new genus of the Inadunate Monocyclic Crinoids referable to the family *Heterocrinidae*.

The cup.—The cup is about 15 mm. high and 17 mm. wide. Five pentagonal and approximately equal basals are presented. The plates of the radial ring differ greatly from one another: three of them are large with a facet extending across the middle third for the insertion of the arms. The other two radials are transversely divided and do not appear to bear arms of the same character as those arising from the larger plates. Owing to the crushed condition of the specimen it is impossible to be sure of the other points in the anatomy of the cup, but it would appear that one of the large radials is somewhat greater than either of the others and that its upper left corner is truncated for the insertion of a small anal. In the drawing (plate IV, fig. 1), the right-hand dotted line represents the uncertain suture between the supposed anal and the contiguous large radial. The middle dotted line is almost certainly a suture and the lefthand dotted line is, in all probability, due to a crack across the superradial. The dissection shown in fig. 4 is drawn on the assumption that the small triangular plate is a true anal. If this conclusion is correct, then the large radial is the right posterior and the divided plates are the left posterior and the

*Geol. Sur. Can., Memoir 15 P., Ottawa, 1911.

right anterior radials. It is to be noted that this arrangement is not in accord with the general habit of the *Heterocrinidae* in which the right posterior radial and the right and left anterior radials are usually the ones divided. All the plates of the cup are thick and heavy with the upper edges of the radials strongly inflected. The tegmen likewise was of fairly heavy construction, but it is not clearly observable.

The arms.—The arms are stout and bifurcate heteronomously: in life, they probably extended to a height of 50 mm. above the cup. The three normal radials bear arms which are inserted on a facet extending across the middle third of each plate. The first primibrach (costal) is axillary: the second or third secundibrach (distichal) is axillary: the third or fourth terti-brach (palmar) is axillary. The arm-segments are somewhat hour-glass shaped and the various branches are of unequal strength. The arms lie in a curved position, which is probably normal. There is some evidence of the occurrence of stout pinnulae at intervals, but the specimen is too poorly preserved to warrant remarks on their distribution.

The right anterior superradial is badly broken but it appears to have carried an arm which maintained its strength to a greater height than the normal arms. This arm does not appear to have arisen from a facet on the exterior face of the radial as in the case of the normal arms. The left posterior superradial shows no evidence of an arm but it is possible that one is hidden under the left ramus of the right posterior arm which lies across the top of the plate. It is certain, however, that the left posterior radial did not bear an arm analogous with the three normal ones.

The anal tube.—The anal tube is a very slender structure about 1.5 mm. thick: it shows three segments in a distance of 6 mm. The tube appears to have risen from the small triangular anal already mentioned. Owing to the imperfect preservation, the interpretation of this structure is attended with doubt. The coincidence of the supposed anal plate and this tube-like structure seems to justify the orientation decided on.

The stem.—The stem is relatively large, having a diameter of 7 mm. at its proximal end. In the 18 mm. exposed by the specimen, there is little evidence of tapering distally. A quinquepartite arrangement is clearly indicated with the subdivisions interradian in position and therefore continuous with the basals. If Wachsmuth and Springer are correct in stating that the segments of quinquepartite stems alternate with the cup-plates of the proximal row, then this form is dicyclic with invisible infra-basals. The stem shows transverse elevated ridges at

intervals of about 2 mm. with finer, somewhat sinuous lines between the heavier ones.

Remarks.—It must be admitted that both the anal tube and the anal plate are of doubtful interpretation and consequently the orientation of the form is questionable. Notwithstanding this uncertainty, the existence of two, and two only, divided radials, together with the lack of symmetry in the arms and their peculiar insertion, justify the creation of a new genus and species. The form seems to foreshadow the *Platycrinidae* of a later period.

GLAUCOCRINUS, GEN. NOV.

Basals five, equal. Radials relatively large. The right anterior and the left posterior radials transversely divided. A small anal rests on the upper left shoulder of the right posterior radial. The three normal radials bear stout bifurcating arms. The other radials support arms of a different character or may lack arms on at least one of the plates.

GLAUCOCRINUS FALCONERI, SP. NOV.

Specific characters as in the general description given above. Named for President Falconer of the University of Toronto. *Type*—No. 610 T., *University of Toronto Museum*.

Formation—Trenton.

Locality—Kirkfield, Ont.

Collector—Joseph Townsend.

The second species herein described is founded on two specimens which are evidently referable to the genus *Glyptocrinus*. Each of the specimens shows a considerable portion of the cup with the stem attached: one exhibits the plates of the cup in an admirable manner; the other, which is less perfect in this respect, shows, however, almost the full extent of the arms. The accompanying figure (plate, IV, fig. 2) has been prepared by combining the features exhibited by the two specimens. It is regrettable that neither example reveals the arrangement of the plates in the posterior interray.

The cup.—In one specimen, the cup is 19 mm. high and 15 mm. wide; in the other, it is about 14 mm. high and 11 mm. wide. As far as can be observed, the basals consist of five similar pentagonal plates, considerably smaller than the radials. These latter plates are of equal size and of an heptagonal outline. The radials are succeeded by two somewhat elongated primibrachs (costals), the first of which is hexagonal and the second heptagonal. The second primibrach is axillary and is succeeded by the secundibrachs (distichals) which occur in single series. The interray shows a lower plate which is hexagonal in outline: this is followed by three pairs of interbrachial plates of which the last pair is interdistichal in position. Above this point, the

arrangement of the plates is not clearly shown, but apparently a fourth pair of interbrachial plates continue the interray to the margin of the cup.

The characteristic features of the species lie more particularly in the ornamentation of the cup plates. From the centre of each radial a strongly marked carina runs up the ray to the middle of the second costal, where it bifurcates and continues over the distichals to the point of origin of the arms. A strong ridge-like carina with sharp, square shoulders connects the centres of the radials, and forms a very characteristic, sharply defined band passing around the cup in this zone. Downwards from the centre of the radial, the carina is broken into two halves, each of which passes to the contiguous basal. No other stellate ornamentation appears on any of the plates, except a faint radial striation on the first interbrachial. All the plates, however, are marked with a distinct granulation which is more pronounced on some plates than on others.

The stem.—The stem is composed of thin discs which are alternately large and small. Near the cup, the larger joints are about two mm. in diameter and occur to the number of three in the space of one mm. Distally, the stem tapers rapidly and the joints become more elongated. Externally the stem-joints are round in section: the shape of the internal passage was not observed.

The arms.—The arms are ten in number: they appear to become free and to be provided with pinnules beyond the second distichal. The joints are distinctly uniserial in arrangement and occur to the number of three in the distance of one mm. in the lower portions of the arms. Bifurcation of the arms was observed in one instance only: the division in this case occurs above the sixtieth joint. The present species is distinguished, more particularly, by the strong carina passing around the cups in the radial zone. The lack of stellate ornamentation on the interbrachial plates distinguishes it from *G. decadactylus* and *G. dyeri*, which are, moreover, Cincinnati forms.

The species of *Glyptocrinus* hitherto described from the Trenton of Ontario are *G. ramulosus*, *G. ornatus* and *G. marginatus*: none of these shows a prominent carina encircling the cup. The small basal plates and slender branching arms of *G. ramulosus* sufficiently differentiate that species. The striking ornamentation of *G. ornatus*, which consists of five or six conspicuous, finely striated ridges radiating from the centres of the plates, serves to distinguish it from the present species. The margined plates of *G. marginatus* and the different arrange-

ment of the interbrachials in that species render impossible any confusion with the present form.

Glyptocrinus circumcarinatus, *sp. nov.*

Type specimen—No. 668 T, *University of Toronto Museum.*

Formation—Trenton.

Locality—Kirkfield, Ont.

Collector—Joseph Townsend.

A FOSSIL STARFISH WITH AMBULACRAL COVERING PLATES.

BY GEORGE H. HUDSON.

(Continued from May number).

THE COVERING PIECES OR EPINEURALS.

This specimen still retains 23 plates covering the food grooves in such perfectly normal positions that there can be no doubt whatever as to their being strictly homologous with the epineurals of Edrioasteroidea.

On the less developed portion of arm I (plate II, figs. 1, 2, 3 and 6) there are 16 of these and on the mature portion of arm IV, next the disc (plates I, figs. 1 and 3; III, figs. 3 and 4) there are seven more. In addition there are 10 other epineurals which are but slightly displaced and whose proper position may be easily recognized—one on radius III, seven on radius IV and two on radius V. Three other displaced and weathered epineurals are also present.

The most distal epineural on arm IV (the eighth of a series) lies flat on the floor of the food groove and clearly reveals the shape of the arm members of a series. They are pentagonal in outline, twice as long as broad, the two long sides parallel; the ends next the marginals have three angles each, the central one of about 85° and well rounded at the apex; each free end is truncate, having two right angles.

Now when we have an ambulacral groove with straight bordering walls we would expect the epineurals to be placed alternately, their truncate ends against the wall and their pointed ends toward the entrant angles between two neighbors of the opposite row as in *Cyathocystis*. We also would expect these inner ends to meet with their marginal faces apposed to each other in close fitting valvate closure and the ridge formed by the plates, when closed, to be low and comparatively smooth (plates flush), to secure additional strength against attack.

Our specimen violates every one of these conditions. The epineurals are opposite; their pointed ends against the straight border of the food groove; their thick, blunted, truncate ends apposed to those of their neighbors of the opposite row; their great length allows these ends to touch only by the inner edges of their end faces (closure not valvate); when closed the ridge is high, the angle at the summit being about 65° (plate II, figs. 3 and 6); the closure at the ends is often very imperfect (see 13th epineural in upper row, plate II, figs. 1 and 2 and the 5th epineural in lower row on arm IV, plate III, fig. 4); the plates are too wide to secure valvate closure at their lateral margins and the majority have these margins imbricated and with either the orad or aborad margins under. These plates, in shape and arrangement, are so at variance with what we would naturally expect that they call to mind the double row of flat spines that protect the food grooves in *Pentaceros*. To derive the latter from the former would seem to require less alteration than that which has already taken place.

Some of these changes might be considered as indicative of a loss of the primary function, but the specialized form of joint and free end and the marked increase in length, breadth, and thickness must be taken to indicate that these changes are all adaptations secured by a new function or functions that were added to the primitive one and finally came to surpass it in importance.

Two possible new functions will be considered; the first of these a new method of securing food supply and the second a new aid to locomotion. Before taking up either it will be necessary to make a brief study of the evidences of the muscular system which our specimen possessed.

MUSCULATION.

That the epineurals are arranged alternately with the adambulacrals below them may be seen by an examination of the fourth and sixth epineurals of the lower row in plate III, fig. 4. The position of the eleventh epineural of the upper row in plate II, fig. 1, and the position which the tenth of this series must have occupied will give additional evidence. In the last figure the epineurals have their free ends swung aborad, in the former figure they are swung orad. This indicates that the epineural adductors were in pairs and their origins were in the very prominent, central, elongated, sunken muscle fields which are so clearly shown on the oral surfaces of all adambulacrals except the first of a series. The muscle pits are commensurate with the size and importance of the epineurals themselves. The adductors were also probably arranged in pairs and the muscle

fields of their origins were on the oral faces of the marginals. These fields were outside of a highly specialized area, were therefore more diffused and their limits are not recognizable.

As all the adambulacrals were free to move in a direction perpendicular to the oral plane, the attachment of the epineural adductors to them necessitated a series of ambulacral depressors with origins on the aboral ambulacral edges of the marginals. The adambulacral floor could be thus raised or lowered while the epineurals were closed.

Plate II, fig. 5, shows also marked muscle pits on the aboral surfaces of the seventh pair of adambulacrals of arm V, while the photomicrographs made for fig. 7 of the same plate showed but faint muscle pits on the aboral surfaces of the fifteenth pair of adambulacrals. These pits represent the places of attachment of one of a series of three adambulacral adductors for each row. It is very evident that the muscles of the peristomial ring could act as abductors of the older adambulacrals.

On younger portions of the arm the orad—aboral movement of the adambulacrals (allowing the adambulacral jaw to be advanced or retracted) was not permitted, as may be seen by an examination of the fourth and fifth arm marginals of arm II (plate III, fig. 1). The ossicles were here so slightly attached to the carbonized bed of the substratum that an attempt to find ambulacrals and aboral plates resulted in the loss of the 13th adambulacral of the lower row. Further attempt to develop this locality was immediately abandoned but the accidental removal of the single ossicle left a perfectly fresh surface, showing the semi-cylindrical groove in which movement perpendicular to the oral plane was allowed while movement along the ray was prevented. The median vertical ridges on the ambulacral faces of these younger marginals may be clearly seen. The younger and weaker ambulacral adductors were thus protected from the pull of the peristomial ring. The change in outline of cross section of the prismatic flooring pieces, while passing orad, is indicative also of change in function. The very marked increase in curvature of what were once prism angles was in part due to a demand for larger fields for origin and insertion of muscles other than those already mentioned.

FOOD CAPTURE.

That the open epineurals of ciliated food grooves had occasionally the chance to capture animals somewhat larger than the organisms making up the mass of the food, cannot be doubted. When our primitive stellerid abandoned the fixed habit and began to find a more abundant food supply in the ooze of the

sea floor such opportunities became more numerous and the covering pieces began to develop along new lines.

Let us suppose that we have an original circlet of ten enlarged peristomial epineurals, that these occasionally capture and crush small organisms and that they can be drawn inward by adductors (turning on their long axis—a power possessed by all the epineurals of our specimen) and thus carry such particles to, and press them into, the oral cavity. The second pairs of epineurals could also occasionally capture organisms and thrust them under the peristomial circlet or move orad over this circlet when it was in the indrawn position. The first circlet might thus come to function as secondary jaws, moving on their in-turned edges over the sloping oral surface of the adambulacral jaws and developing permanent sliding joints. At a later stage the second epineurals would come to be placed permanently over them and assume the original functions of the first circlet.

Now, in our specimen we have throughout the food groove an epineural for every adambulacral save the first. Orad of the first, however, and resting on it by a marginal face is a single plate which we must consider as a modified epineural of an earlier circlet which has wholly lost its original function.

How profoundly this earlier circlet has been modified may be seen by noting the present form of these plates. The marginal faces in contact with the adambulacrals have been widened and beveled to make a good sliding joint fitting the V shaped groove formed by the contact of the latter. This may be seen in plate III, fig. 2, a side view of a pair of these plates and taken before they had been more fully freed from the matrix. The faces apparently resting against the "torus?" are also widened. The outer marginal faces are narrower and consist of an aborad short portion and a longer orad portion that appears to be of the nature of a rounded, blunt, movable spine. The remaining marginal face of each plate shows an inner heavy blunt tooth below the smaller rounded tip of the spine-like piece. The broad contiguous face of each pair was flat and close fitting.

As the plates of the secondary jaws assumed more and more an indrawn position the second pairs of epineurals moved permanently orad and met over them. The secondary jaws being powerful organs of defense, a complete covering of the peristomial cavity by the second circlet was not necessary. This new circlet (marked as first epineurals in our figures) was thus free to increase the diameter of the central capturing ring, which they did by shifting their attached ends farther aborad. We find that they have encroached on the higher oral face of the interradial marginals and secured thereon well marked excavations with a clearly defined semicircular aborad border (plate

III, fig. 1). The proximal ends of each pair of these plates were cut to form a half circle and they could be drawn either aborad to the ridge, or some distance orad. We here have another ring of sliding joints aiding in food capture. The distal ends of these epineurals seem to have retained a primitive central angle that enabled them the better to hold their prey or to break the shells of small mollusca. molluscoidea or crustacea. These plates could be raised or lowered and each pair could open and close like a pair of pliers. The shifting of the position of their proximal ends allowed them to assist in the capture of eggs, young, or adult organisms up to 4 mm. in diameter and enabled them also to press food into the space where the secondary jaws could act upon it.

The epineurals marked (2) were directed orad and their attachments were along a diagonal edge which also rested in a somewhat elevated socket on the oral edges of the interradii marginals. The oral faces of these marginals also show the fields of origin of the abductors of these more specialized first and second epineurals.

The remaining epineurals could function somewhat after the manner of a duck's bill, for they could grub in the ooze and press the mud out between the plates. When the epineurals were all closed the captured and separated food contents could be moved orad by a progressive wave movement (trough and crest) of the ambulacral floor. The ability to shift the free ends of the epineurals orad or aborad and to move either half of an ambulacral floor would assist in the process. The evidence for this manner of food getting is abundant and should be conclusive.

THE HOMOLGY OF THE PERISTOMIAL PLATES.

We must note that to carry the alternate arrangement between epineurals and adambulacrals to the interradii mouth angles and complete the paired series of epineural adductors would require the presence of either a single unpaired epineural or adambulacral in each interradius. If the primitive circlet of peristomial covering pieces were five in number the "torus?" may represent this primitive unpaired epineural. Figs. 3 and 5 of plate III (interradius 2) suggest such a derivation. If on the other hand the odd plate was an adambulacral our "torus?" might represent that plate. In the figures, however, it seems too far removed from the adambulacrals to belong to the series. What we have called the oral might be an odd adambulacral and in this case we should consider the interradii marginal to be the true oral. If the oral surface (left uppermost after death) sank into contact with the ossicles of an aboral circlet then our "torus?" might be an aborad interradii and the plate uncovered

in interradius 1 (plate III, fig. 3) is strongly suggestive of such a plate with a genital opening. We should consider also the possibility of developing, from our "secondary joint", a true Ophiuroid torus with its spines. These suggestions are made here for the purpose of calling attention to the fact that we are in need of a consistent terminology that can be applied to all classes of Echinoderms and because of the evidence which this specimen, as yet only partially "developed", has to present concerning this matter. It is suggested that we may inaugurate a better terminology by using 'epineural' for "ambulacral" in the Crinoidea, and using a new term altogether for the term ambulacra as now used in the Asteroidea. Could I have used "ambulacra" in place of "adambulacra" in this paper I should have been glad to do so but the plates for which I would have used this term are not the ambulacra of Asteroidea.

LOCOMOTION.

The relatively short arms, the small number of marginal ossicles, their flat and close fitting contiguous faces, the absence of re-entrant angles for muscle fields and the marked broadening of the arm as it approaches the disc all speak of rigidity. The arm could neither be used for feeding after the manner of *Asterias* nor could its lateral bending alone have been its means of locomotion.

On the other hand if progress was by means of tube feet with suckers, those long projecting epineurals would make a very effective drag. We may easily recognize the difficulty of moving this veritable harrow over seaweeds or dead shells on a hard bottom unless the epineurals could so shift their position as to adapt themselves to motion in any direction. If they could thus give passive aid there is no reason why they might not give active aid. Tube feet with suckers would be useless on soft bottoms, such as that on which our specimen died, while its spade like epineurals might be used to shift its position over its feeding ground.

Astropecten affords us an important suggestion. "Owing to the loss of suckers it is unable to climb over rocks and stones like the ordinary species, but it runs over the surfaces of the hard sand in which it lives by means of its pointed tube feet."¹ The long and heavy epineurals moved by powerful muscles ought at least to be as effective agents of locomotion as pointed tube feet.

That some arm movement was allowed is shown by arm I in fig. 3 of plate I. The tip is not only turned toward one side

¹ McBride, "Cambridge Natural History" Vol. I, Page 468.

but it was curved toward the aboral surface. The joints formed by contact of the first arm marginals with the interrarial marginals are all gently concave aborad and suggest sliding or shallow ball and socket joints. The movement may have been something like that of the Ophiuroidea, the side arms being lifted and set forward and the epineurals holding like anchors or helping in the forward thrust. In that case our orientation, based in part on arm position, may be in fault. Aside from the ability of the long epineurals to open widely and close, the angle at the fixed end of about 85 degrees indicates an ability to swing their free ends through an arc of some 95 degrees in a radial direction. We have already noted that the preserved plates on the two arms are set in opposite directions if considered radially. With reference to the environment, however, they are set in the same direction and are in the position we should expect if they had been used to assist in thrusting the creature in the direction of the third interradius.

SOME GENERAL CONSIDERATIONS.

We all know that the more primitive Echinodermata possessed food grooves with covering plates such as we find in Cystidea, Crinoidea and Edrioasteroidea. In 1907¹ I described the covering plates in Parablastoidea (Blastoidocrinus) and in 1911² after further work on the same species I endeavored to show that with regard to Pentremites we must "accept Doctor Carpenter's contention that the mouth, food grooves and pores were covered with small but well fitting plates." We now have found undoubted covering plates in the Stellerioidea.

I desire to point out that the food groove with a double row of flooring plates covered by a double row of epineurals and flanked by one or more marginal plates on either side is a very primitive type of food groove and I believe that *Protopalaeaster narrawayi* not only points out the fact that the Stellerioidea arose from such a type but that the Echinoidea also had a similar parentage.

With so simple a form before us we must ask ourselves if the ambulacra and interambulacra of Echinoidea and the "vertebral ossicles" and "lateral arm plates" of Ophiuroidea are not strictly homologous with the adambulacra and marginals of our type and of the Edrioasteroidea.

The very evident specialization of the peristomial covering plates of *P. narrawayi* for food capture and mastication would

¹ "On Some Pelmatozoa from the Chazy Limestone of New York." In New York State Museum Bulletin 107, p. 112.

² "Studies of some Early Seluric Pelmatozoa." In New York State Museum Bulletin 149, p. 208.

suggest also that the Dental Apparatus of the Echinoidea had a similar origin. The still greater specialization here lead to an early loss of the little used epineurals of the outer portions of the ambulacra. Covering plates or epineurals in Echinoidea were undoubtedly once present and if not already found we may with every reason still expect to find them in older members of this group.

The absence of the usual members of an aborad skeleton and the presence of the shifted interrarial may lead others to consider that we are viewing the aborad face of the oral skeleton. This would make Stelleroid ambulacra of the plates here designated as epineurals. I may say that I have myself entertained this idea only to reject it and I am prepared to defend my position.

THE EVOLUTION OF THE WORLDS.

By J. S. PLASKETT, B.A., F.R.S.C., THE OBSERVATORY, OTTAWA.

(Continued from page 34).

And now what happens when the particles begin to move towards the centre of gravity. Work is done by them and, as the form that work done eventually takes is heat, it is evident that, as the nebula condenses under its own attraction, the temperature rises, it grows hotter. A very striking example of condensation accompanied by heat must have been often noticed by those who use automobiles or bicycles. When air is pumped into the tires, the pump becomes quite hot. Possibly some of you have put this down to friction but you would find it impossible to generate much heat by running the plunger up and down in the open. You push the air particles closer together, do work on them, which is converted into heat and the temperature rises. On these two laws, that of gravitation, and that of the transference of work into heat is based the whole scheme of stellar evolution. Gravitation is the force that impels the particles to do the work that is transferred with heat. As condensation of the nebula proceeds it grows smaller, approximates in form to a sphere, gets hotter and hotter and becomes star or sun-like in its form and temperature.

It may be as well to digress for a moment and try to get a clear conception into our minds as to the physical condition of the stars. The great majority of the stars or suns are entirely gaseous, composed of incandescent vapors at enormously high temperatures, our sun about 11,000°F., while the white and

blue stars are much hotter. The temperature cited is that of the outer visible radiating surface, that of the interior must be inconceivably hotter. Such enormous differences of temperature between the stars and the absolute zero—460°F. of space must inevitably produce a turbulent seething system with uprushes and outbursts of the hotter vapors from the interior producing violent eruptions examples of which, though probably on a comparatively mild and small scale are given by the solar prominences.

Try and picture to yourselves such a body as I have described. A turbulent seething mass of gases and vapors at a temperature even on the outside several times as high as we can get on the earth and of almost inconceivable size up to 50 million or more miles in diameter. Even the most vivid imagination must fall far short of the stupendous reality.

Having this picture in our minds let us return to the nebulae and before going on with their development let us also have in our minds their appearance. I have a number of photographs of the nebulae, made by reflecting telescopes, which show us much more than can be seen visually and indicate the varied and complex structure of these objects.

Starting then with a nebula of comparatively simple form, whether gaseous or meteoric in character is immaterial, as the result will be the same, we have it condensing and growing smaller under the action of gravity and hotter under the conversion of work into heat. As the temperature rises it begins to glow, the more volatile elements are vaporized it becomes more nearly spherical in form and is a deep red star giving a banded or fluted spectrum, indicating the presence of chemical compounds only existent at moderate temperature. As condensation proceeds the body gets hotter and yellower, the flutings disappear from the spectrum, and large numbers of metallic lines, characteristic of the second type of spectrum, similar to our own sun, appear. At this stage the star is still very tenuous, probably considerably less dense than our own atmosphere, and at a temperature of about 10,000°F.

Further condensation with its resultant increase of temperature has the effect of driving to the outer atmosphere the more volatile and lighter elements such as hydrogen and helium and thus diminishing and suppressing the metallic lines resulting in a much simpler spectrum containing very broad and dense hydrogen lines and a few faint metallic lines and in some stars the hydrogen lines only. The star is now white or bluish white in color the temperature is from 15,000° to 18,000° F., and if the body is of moderate size, about the same as our sun, it has reached the height of its evolution, its maximum temperature;

and from now on, through condensation continues the temperature begins to fall. If, however, the star is very massive, the temperature rises still further and we have the lines of helium appearing with occasionally silicon and at the still higher temperature of 20,000° F. and over.

From this period onward the temperature begins to fall, very slowly of course, with pauses, and yet with a downward trend. The star is shrinking gradually, becoming denser but owing to its density the shrinkage is not so great, the quantity of heat produced does not quite equal that radiated, and the temperature must inevitably fall. Hence it becomes yellower and passes through the same or nearly the same spectral types as in its ascending phase. It is believed that our sun is on the descending scale of temperature, is at a stage where the change is very gradual, where the loss of heat through radiation is nearly neutralized by that gained through shrinkage. It has been calculated that a contraction in its diameter of 300 ft. a year is sufficient to compensate for the heat lost by radiation. At that rate in some 12,000,000 or 15,000,000 years it will be so dense as to be incapable of further contraction, will then relatively rapidly solidify and cool down and become a dead sun while its attendant planets will soon reach the temperature of outside space—460° F. and all life will become extinct. This comparatively short time that must have elapsed between the time when our globe was in a molten condition and the present, a time which according to the contraction theory can not be more than about 50,000,000 years and which is much too short for the geologists who require the earth to be hundreds or even thousands of millions of years old, may be indefinitely extended on the assumption of the presence of a comparatively small quantity of radio-active material. Even supposing that the energy given off by substances like radium played a very considerable part in compensating for the enormous loss due to radiation yet it is inevitable that finally there must be loss of temperature and gradual cooling down of all the stars.

The plan of evolution here developed which postulates both an ascending and descending scale of temperature differs from that generally held which assumes that the development is from the nebulae to the white and blue stars without intermediate stages and then by descending stages to yellowish and red stars and extinction. Although such a plan, requiring both ascending and descending scales of temperature was formulated by Sir Norman Lockyer many years ago it did not receive much support and it is only within the last year or two that it has come into favor chiefly by the evidence collected from many sources by Dr. H. N. Russell of Princeton University.

As we have seen, the whole tendency of stellar evolution is towards a loss of energy, a cooling down, and eventually all the stars we now see will become dead and invisible; and, unless there is some means of replenishing this energy, the whole universe will get to one level of coldness, invisibility, and deadness. Do we know any means by which such a dead system may be revived? So far as any energy from within each body is concerned, no. Nevertheless, each of these bodies contains an inconceivably vast store of kinetic energy, energy of motion. They are all moving in all directions with velocities varying up to about 200 miles per second on the average about ten miles a second. Although they are relatively small as compared with the vast distances between them, nevertheless in the hundred million or so of stars in the visible universe, it is certain that some pairs will come within range of each other's attraction, will be drawn towards each other with constantly increasing velocity and will, under certain conditions, collide either directly or with grazing contact. What will then happen? We know what would happen if two projectiles from modern cannon, each moving with a velocity less than half a mile per second and weighing less than a ton were to collide. They would be practically destroyed and made intensely hot. We cannot conceive the destructive effects of the collision of two bodies, billions upon billions of times as massive as our cannon balls, and moving, as they would be at the instant of collision, about a thousand times as fast. They would certainly be entirely vaporized with explosive violence and scattered over an enormous space and we would have again a nebula which would undoubtedly pass through the process of evolution already described.

This is a very fascinating hypothesis, that the universe contains in itself the forces which will keep it in existence, in undiminished glory. Although we do know that such collisions will occur and have occurred, we do not know whether they are of sufficient frequency to renew the loss of energy constantly going on. That such collisions occur is attested by the appearance of new stars (Novae) which come from time to time. The most notable in recent years (1907) was in the constellation Perseus. It was discovered by a Dr. Anderson of Edinburgh, who only a short time previously discovered a less striking Nova; it suddenly appeared where no star had been previously, blazed up in the most spectacular manner so that in a few hours it was brighter than any star in the sky, and then nearly as rapidly faded. It now has the appearance and gives the spectrum of a nebula. There can hardly be any doubt that these novae

are due to collisions and that after the vapour has cooled down they become nebulae ready to again develop into suns.

We may be able to roughly compute the probability of such collisions maintaining the energy of the universe. We may assume that the time required for a body to be developed from the nebula, pass through all its stages to extinction, is of the order of 500,000,000 years. If we further assume that there are 100,000,000 stars in the visible universe it is evident that if a new star and in consequence a nebula were to appear every five years, it would suffice to maintain the universe at its present brilliancy. As a matter of fact, there seems to be no doubt that, from the past few years, new stars have appeared at intervals of from 5-10 years, which, allowing for the fact that the less brilliant of such objects may easily escape detection, seems sufficient to establish a continuous cycle of development of the universe.

Hitherto we have considered the evolution of the stars or suns themselves from the primal nebula, and have passed over, what is fully as important from our standpoint, the formation and development of planetary systems. Now that we have, I hope, obtained some idea of the methods and laws governing the formation of suns, we will have to consider those relating to the attendants of the suns, the planets, and we will find that the same principles apply. We know, of course, that our own sun has a number of planets revolving around him, and travelling with him in his journey through space but we have no means of knowing except by analogy whether other stars are similarly accompanied for even the largest of telescopes could not possibly detect planets like ours. We do know that the double stars, pairs of suns revolving around one another, can not have attendant planets as the perturbations would soon cause them to be drawn into one or other of the pair. The latest estimate places the proportion of double stars as nearly one-third of the whole. Of the remaining two-thirds, it seems probable that the conditions, which gave rise to planets in our own system, should be effective in many if not most of them, and there are likely many millions of planetary systems throughout the universe.

The history of the development of planetary theories is a most interesting one, but I have not time to more than briefly touch upon it. Although some vague and curious notions were entertained by the ancients, it was not until the middle of the eighteenth century that Wright of Durham, England, published a theory of the universe. This was read by the young philosopher, Kant, who at once turned his brilliant mind to the problems of cosmogony, and in 1755 published a treatise on the subject, marked by the beauty and generality of its treatment,

but faulty in some of its arguments from his imperfect knowledge of physical laws.

The theory of the evolution of the solar systems commonly called the nebular hypothesis, which held undisputed sway for nearly a century, and which still, in spite of many contradictions recently discovered, occupies the premier position in the minds of scientific men generally, was enunciated by the great French scientist, Laplace in 1796.

Laplace called attention to the fact that all the motions of rotation and revolution in the solar system then known were in the same direction and almost in the same plane. He computed that the probability of this being a mere accident was about one part in 500,000,000, conclusively showing it to be due to some initial state from which the system had developed.

This theory as amended by himself, and with some later additions is, that our system was originally a nebula probably somewhat condensed towards the centre, which extended beyond the orbit of the farthest planet, that it rotated as one body in the direction in which the planets now move and that it gradually condensed and got hotter under the mutual gravitation of its parts, exactly as we have already postulated. Simultaneously with the contraction, the rate of rotation necessarily increased from a well known dynamical law. After some time the centrifugal force at the equator became equal to the central attraction, and a ring of nebulous matter was left off, the remainder continuing to contract and leave off rings at the distances of the planets. The rate of rotation and the temperature of course increased with the contraction.

The rings left off scarcely could have had a uniform structure and, separating at some point, would coalesce forming the planets, while the satellites would be formed from rings left off from the contracting planets, Saturn's ring being an example still remaining. By the time these rings had formed planets and these latter had cooled down to a solid condition, the central part, the sun, would have gone through some of the changes outlined previously, and would have reached its present condition of approximate equilibrium, the loss of heat due to radiation being compensated by the gain due to contraction.

Such is the nebular hypothesis which remained unquestioned for more than half a century, and which has exercised an incalculable influence on the science and philosophy of the nineteenth century. Unfortunately the nebular hypothesis, beautiful and complete as it is, can not, in the form it was left by Laplace be made to account for the facts as they are now known. It has, since about 1860, been subject to continuous attacks and if now accepted must be in a considerably modified form. A

brief statement of the phenomena in agreement and disagreement with the theory may be of interest. In agreement:—

1. The planets all revolve nearly in the same plane and in the same direction.

2. Their orbits are all nearly circular.

3. The sun and the planets, so far as known, rotate in the direction in which the planets revolve.

4. The planes of the equators of the planets and of the orbits of their satellites are nearly coincident with the planes of their orbits (Uranus and Neptune excepted).

5. The satellites revolve in the direction that the primaries rotate (9th of Saturn and 8th of Jupiter exceptions).

6. According to the contraction theory of the sun's heat, this body was once vastly larger than at present.

Some facts inconsistent with the Nebular Theory. :—

1. The orbits of the asteroids are contradictory to the theory.

2. The rapid revolution of the inner satellite of Mars and of the particles of the inner ring of Saturn can not be satisfactorily explained.

3. The presence of light elements in the earth is not to be expected.

4. A series of rings could not have been left off.

5. A ring could not have condensed into a planet.

6. The retrograde revolutions of the 9th satellite of Saturn and the 8th of Jupiter contradict the theory.

Various modifications of Laplace's theory to meet these objections have been brought forward by Roche, Faye, Ligoudes, Ball and others, the chief of which dispenses with the troublesome process of ring formation and condensation and starts the planets by condensations around accidental nuclei in the parent nebula. The most exhaustive criticism of the nebular theory is that by Moulton and Chamberlin, published in 1900, who, by combining observed facts with dynamical principles show that in its present form it fails to account for many of the phenomena of the Solar System.

An alternative hypothesis has been developed by these writers called the Planetesimal or Spiral Nebula Hypothesis. It probably owes its origin to the fact that the researches of Keeler with the Crossley Reflector at the Lick Observatory showed that the predominant form of nebula was the spiral, and that no known nebula has a form agreeing with Laplace's Ring Hypothesis.

The authors of this theory assume that our system was originally a small spiral nebula and explain the formation of the spiral nebulae by the collision theory already dealt with, or

rather by the particular case of collision in which the contact is only grazing, or in which there is only a near approach. The chances of these two latter conditions are of course much greater than direct collision. In such cases the tidal strains induced, added to the eruptive tendencies of highly heated gaseous bodies, will cause masses of matter to burst out and recede to great distances. They show mathematically that the tendency will be to assume a two armed spiral form; and the secondary nuclei with the planetesimals, as the finer matter is called, will revolve in elliptic orbits around the central sun. The secondary nuclei at irregular intervals in the arms of the spiral will gradually attract the smaller finer matter in these arms, and will, in doing so, tend to have their orbits made more nearly circular and become the planets. Explanations are given by this hypothesis of many of the difficulties of Laplace's theory, but only in a qualitative way, and, it seems to me, it has yet to stand the test of the quantitative criticism that was so long directed at the older hypothesis.

More recently, about two years ago, a series of abstruse papers dealing with the effect of a resisting medium in modifying the orbits of planets and satellites has been published by T. J. J. See but so far as I can learn the author's opinion of them is much higher than that of any one else's.

The question of the origin and development of our own system, and of other systems as well, is still therefore in an unsettled condition. On some things all are agreed, the chemical unity of the cosmos, the nebular source of the whole system and its development under the action of gravitation, the transference of work into heat and other dynamical laws form common starting grounds and are in reality of course the essence of the whole matter. Whether the nebula was gaseous or pulverulent, planetary, spiral, or any other form, how it became ordered and organized and how it collected into spheres, the wisest are perplexed to decide. There seems to be no question that, while the Laplacian hypothesis contains the germ of the truth, the process of development was by no means so simple and direct as was therein stated, and that we do not yet know the precise mode of development of the solar system.

And yet, behind and above and before all this development and evolution we have been talking about, even the most sceptical must admit the presence of a Supreme Power, a Power which must have created in the first place, and a Wisdom and Beneficence which so ordered and arranged the development of Creation as to make it the result of the action of natural laws. And yet not less wonderful is the Love, which created the human mind and gave to it the power, though inhabiting for only a

few years this minute planet, the attendant of a comparatively insignificant star of the system, to reach out to the inconceivable depths of space and reduce the apparent confusion of stars to orderly systems, to deduce the laws which govern these systems and thus unify to a certain degree all the wonderful phenomena of suns, planets and comets, stars, nebulae and clusters into one whole. We are surely all convinced that it will not rest there, but will eventually still further unravel the mystery of the universe.

EXCURSIONS.

The first outing for the Spring of 1912 was held on Saturday afternoon, the 27th of April, to Beechwood. The weather was fine at first, and a large number of old and new members and leaders gathered at the place of meeting, and then walked along Beechwood Avenue to the woods on the left hand side of the road. Only a few of the early spring flowers were out, but they were welcome as old friends, and eagerly gathered. It is a well-explored locality and no new or rare plants were discovered, but some plants in their early stage of growth presented an unusual appearance that would puzzle all but an expert. This was exemplified afterwards when a leader in botany passed around a tiny seedling and no one recognized it. Then he said it was a cedar. The name sounded like "Sedum", and the needle-like leaves did not look unlike the linear leaves of some of the stone crop family. When he passed around a slightly more matured specimen with the ordinary foliage developing, everyone was able to recognize it.

Unfortunately the weather turned cold and cloudy, and the meeting closed abruptly without a complete list of specimens being named.

E.H.B.

NOTE.

The Riding Mts. of Manitoba will probably be noted in some future day as a game reserve. If present plans materialize a considerable section of the interior of the Forest Reserve will shortly be set aside as a permanent home for big game. Elk, moose, mule-deer, bear and beaver are plentiful. Beaver are so numerous along the Whirlpool and other streams flowing from the mountains that they are actually a menace to the farmers owning meadows. Whole clearings of poplar, log-slides, recently built dams and lodges are to be seen in various places.

J. M. S.

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POPULAR AND PRACTICAL ORNITHOLOGY.

III.—THE UPLAND PLOVER.

BY NORMAN CRIDDLE, TREESBANK, MAN.

When viewed from a short distance, Upland Plovers might be described, briefly, as grayish-brown above; the colour in reality, is made up of gray-brown and black markings. Beneath, they are white with black arrowhead-shaped dashes on the upper breast and along the sides. They average about twelve inches in length.

This plover, so far as Canada is concerned, is a bird of the Middle West and though it is found in migration, casually, from coast to coast, its chief breeding grounds are western Manitoba and eastern Saskatchewan, extending, however, southward to Virginia and northwesterly to Alaska. It winters in Mexico and South America.

This bird has previously passed under a variety of names, many of them local. Until recently, it has been known as Bartramians Sandpiper. The popular tongue however, was never able to master such a cumbersome title and so the A.O.U. changed it to one more easily uttered and which was already in common use in various parts of the bird's range. The name, as it is, is also a very appropriate one, applying as it does to a bird that is decidedly upland in habit, preferring the dry prairies which are broken by small bluffs, particularly if the land be sandy. There is reason to suspect, however, that this preference for sandy soil is, after all, due not so much to an actual liking for the soil as for the food found upon it. Such soil, on account of its extra heat and inability to support as dense a vegetation as the richer land, proves much more suitable for the breeding locusts, more particularly those species that lay their eggs in the ground. Here they flourish and if not checked, often become troublesome pests. Now, the chief food of Upland Plovers is these very members of the order Orthoptera—locusts, grasshoppers or any other of the hopper tribe. Hence, the association is more than probable due to food considerations.

In Manitoba—and it is of that Province I write more particularly—this plover reaches us from the south, on an average, about the first or second of May. It comes up in a leisurely manner, often pausing to utter its quaint song, by which means and its oft-uttered call note, its arrival is easily detected and its departure southward recorded by the same means, minus the song.

To begin with then, sandpipers roam the prairies in pairs, picking up most of the soft-bodied animal creation that is unfortunate enough to attract their attention. Grasshoppers, however, unquestionably form the chief article of diet at that time, as there is no mistaking the rapid runs, first one way and then another. They resemble a human being trying to catch a frog, and such actions can only be caused by an insect that hops. In June, these birds begin to seriously consider the rearing of a family and seek out a suitable tuft of grass or some other object near which to build a nest, so that there will be some sort of shelter affording protection both from the weather and enemies, though I do not think the latter precaution is a very necessary one, as the birds, with their mottled coats are admirably adapted for concealment; in fact they harmonize almost perfectly with the herbage in which they are found, and I cannot remember ever having detected a brooding bird before she left the nest, though often fully in view. The nest is found in various situations from the centre of low open bushes to unbroken prairie or the tops of sand dunes where the vegetation is very scanty. The nest is sunk in the ground and is lightly built of grass with occasionally a feather or two for lining. In this the bird lays from four to five eggs of the usual sandpiper type, large and mottled. The eggs for the size of the bird are remarkably large and one wonders how such a small bird lays such large eggs. On account of the size and the long time they take to hatch, the young when they do appear are so well developed that they can run actively and immediately leave the nest. The actual brooding, so far as I am aware, is done by the female alone, but the male is seldom far away and he takes an active part in caring for the young. At this time the female is bold and wise in defence of her offspring, readily resorting to such artifices as feigning death or injury, and I have known them to fairly fly in my face as I stooped to pick up a little one, uttering weird cries meanwhile. They become very noisy as the young grow and their perpetual callings to attract attention get rather monotonous, especially when one is trying to listen for something else.

In the early eighties these birds were everywhere and their cries and songs could be heard at any time of the day while

their graceful movements on the wing and the pretty habit of raising their wings above their backs when alighting was a pleasure to behold. Then, too, they were quite fearless, allowing a very close approach, as if having perfect confidence in the human invader. Alas for such confidence; it was requited indeed! Yes! with a gun. So that to-day even our innocent little plovers have learnt the lesson of experience that others had learnt too late. They are, as we might expect, no longer the trusting innocents of the past, though still far from wild during the breeding season. Their lesson has been a costly one and for the thousands that previously roamed the whole country of their adoption, we now have but a few, restricted to certain districts where as yet mankind has been unable to destroy them all. Of course the rapid settling up of the land has also greatly reduced the breeding area. In the south, naturalists and sportsmen too, are beginning to become seriously alarmed at the yearly decrease of breeding birds and in consequence a permanent close season is advocated. In Manitoba, however, though progressive in most of our game laws, we still have an obnoxious law enabling the killing of Upland Plovers in July, at a time when many of the birds are still nesting and in defence of their young can actually be knocked over with a stick.

It was my good fortune some years ago to discover a nest of one of these plovers in a situation that I was obliged to visit daily. It was close to some bushes and in rather an unusual situation, being on lowland. Here I saw the bird twice or three times a day, and with patience soon taught her to have confidence so that eventually I could touch her without her leaving the nest. She also learnt to pick up the grasshoppers I threw to her. Her male, however, was absent and never showed up during the weeks we kept company, so I suspect he had fallen a prey to one of the numerous snares that are met with in nature. I do not know how long the female had been sitting when I first met her, but it was close upon four weeks from that date before the young emerged from the eggs. I found them all one afternoon, but a few feet away from the nest, perfect little striped balls of fluff on long stilt-like legs. I gathered them into my hands and here they squatted, "peeping" apparently quite contentedly as if their mother had instructed them that here was a mortal to be trusted. No doubt she had omitted to give the signal that would send the young into hiding. She stood but a few feet away quite unconcerned while I had her little ones, and when at last I let them gently down she made no effort to lead them away but stood watching me, and thus I left her to see her to recognize no more. I have often wondered since whether her confidence was extended to others and

if so whether it led, as I fear, to her losing her life as is so often the ultimate fate of wild animals, particularly the small and weak ones that are led to place reliance upon mankind.

As soon as domestic ties are over for the season our plovers pack up, so to speak, and make their way southward. The first matured are ready to depart quite early in July and after that date they may be heard nightly calling to each other as they move rapidly away. By the middle of August nearly all have vanished though a few belated individuals remain into September, occasionally as late as the third week.

There is a strange circumstance in connection with the autumn flights in comparison with their northward movements in spring. In the spring they come up in a leisurely manner, often pausing in their wing beats to utter their peculiar but pleasing song. At this time too their forward movements seem to be largely controlled by the tips of the wings, indeed this is quite a characteristic of the spring flight. But in autumn they have quite another type of flight; then they seem to use the whole wing and fly much more like a snipe and like that bird are remarkably rapid in their movements. The sailing motion has all gone, and instead of the somewhat slow moving bird of the breeding season we have one that for quickness can vie with many of the fastest, and but for the cries, method of alighting, and vesture, would not be recognized as the same species. It is, no doubt, this strange change of habit that has given the bird a different reputation in the south, where it is spoken of as being very shy and difficult to approach. Yet another peculiarity is the fact that in the spring they are almost without exception day fliers, having a preference for the morning, while in autumn they seldom migrate at any other time but night. This curiously enough is just the opposite to the habits of night hawks which in spring move northward in the evening or at night, and south in autumn during the afternoon.

It seems unnecessary to go extensively into the food habits of Upland Plovers. I have observed them time after time picking up locusts and have also actually seen them chase a moving stone that was thrown at them, under the impression that it also belonged to the order Orthoptera.

Some years ago owing to a controversy on the subject of food habits, relating more particularly to the capabilities of plovers being able to devour large grasshoppers, I secured a few specimens of the bird and examined them; my brother did likewise and we found them literally crammed with hoppers both large and small. The number they consume in a day must be enormous, and as they continue this diet throughout the season of their sojourn with us and do no appreciable harm their preser-

vation is surely desirable even if we only look at the question from the standpoint of dollars and cents.

EXCURSIONS.

The second excursion was made under ideal weather conditions on May 4th. The party assembled at the Wychwood car station about 3.30 p.m., and under the guidance of the leaders for the day proceeded to study the fauna and flora of the area lying between the car station and the river at Blueberry Point. For most of the members the chief object of search was the Mayflower or Trailing Arbutus (*Epigaea repens* L.) which was met with in considerable quantity, few of the searchers being disappointed in obtaining specimens. From the point of view of the genuine field naturalist some members were perhaps too successful in collecting it. Amongst other ericaceous plants noticed were the Bearberry (*Arctostaphylos Uva-ursi* (L.) Spr.) and the common Winter Green (*Gaultheria procumbens* L.). The former of these was in full bloom while the latter was often conspicuous by its scarlet fruit. Hepaticas were in great abundance, and it was noticed that they were all referable to *H. triloba* while specimens gathered at Aylmer Park were those of *H. acutiloba*. The common or White Elm (*Ulmus americana* L.) and the Red Maple (*Acer rubrum* L.) were observed in flower. Amongst the conifers noticed the Red Pine (*Pinus resinosa* Ait.) and a variety (var. *depressa* Pursh) of the common Juniper are worthy of mention. In addition to the flowering plants a number of interesting cryptogams were collected. These included *Lycopodium complanatum* L. var. *flabelliforme* Fernald to which is given the English name of "Ground Pine" in the new edition of Gray's Manual, although many of us have learned to know another species (*L. obscurum*) under this name; the Spiny and the Crested Shield Ferns (*Aspidium spinulosum* and *A. cristatum*); the so-called Reindeer "Moss" (*Cladonia rangiferina* (L.) Web.)—in reality a lichen and one of the most beautiful representatives of the group; and an early ascomycetous fleshy fungus (*Helvella* sp.).

The students of animal life were not perhaps so fortunate as the botanists, but a fair number of birds were seen, including two new arrivals, the Myrtle Warbler and the Pine Warbler, the latter of which is an uncommon spring migrant here.

Short addresses by Mr. Calvert on the birds, Mr. Halkett on the other animals, and Dr. Malte and Mr. Eastham on the plants observed closed an excursion whose only drawback was its brevity.

J.W.E.

The third excursion was held on May 11th. A fair number of members and friends assembled at the terminus of the Britannia car line. From there one party went with Mr. Wilson to study some of the geological features of the locality as shown in sections exposed in a neighbouring gravel pit, another with Mr. Halkett to search the pools in an area of swampy land for animals, while the remainder made their way to a wood at Britannia Highlands. Here the various spring flowers were met with in great numbers, and although nothing of special botanical interest was noticed it was very pleasant to see once again so many woodland favorites not noticed previously this season. Trilliums, both white and red, were in profusion, the former being gathered in great quantity, while the ill perfume of the latter, with its flesh-coloured petals, caused it to be eschewed. Bellwort (*Uvularia grandiflora*) and Dog's Tooth Violet (*Erythronium americanum*) were also very plentiful and amongst other flowering plants noticed were the Blue Cohosh, Jack-in-the-Pulpit, Squirrel's Corn, Golden Corydalis (*C. aurea*), Twisted Stalk (*Streptopus roseus*), Wild Strawberry, False Mitrewort, Small-flowered Crowfoot (*Ranunculus abortivus*), and the Dwarf or three-leaved Ginseng, also known as Ground Nut (*Panax trifolium*). The Crinkle-Root or Pepper Root (*Dentaria diphylla*) was almost in bloom and one specimen was gathered with its leaves covered with the White Rust of Crucifers (*Cystopus candidus*), not previously noticed this season. The foetid or Skunk Currant (*Ribes prostratum*) was also plentiful in moist places and is noteworthy not only for its odour but also on account of its erect racemes of flowers. Barren Strawberry (*Waldsteinia*) and June berry (*Amelanchier canadensis*) were also seen in flower, and a little further away a swamp of *Spiraea*, probably the Hardtack (*S. tomentosa*), was observed. The Oak Fern was just opening out its fronds, while the Marsh Shield Fern was rather further advanced. The Sensitive, Christmas, and Shiny Shield Fern were also noticed and four species of Horsetail (*Equisetum arvense*, *E. scirpoides*, *E. sylvaticum* and *E. hyemale*). On returning, a pool covered with a floating Liverwort (*Ricciocarpus natans*) was also found. Two interesting species of fungi were seen, the Scarlet Cup (*Peziza coccinea*) and the Earth Star (*Geaster*). The former bears its cup-like fruit bodies, one or two inches in diameter with the interior of a brilliant scarlet colour, on the ground, but on carefully removing the soil from around them each will be found to be furnished with a stalk by which it is attached to a decaying branch buried below the surface of the soil.

At five o'clock the several parties reunited in the park, and the leaders gave a brief account of what had been observed on

gathered. Mr. Halkett showed zoological specimens gathered and spoke of the convenience of a Latin name which is the same in all countries. Mr. Calvert, for the ornithologists, told of the birds that had been observed. Dr. Malte determined many plants which had been collected, and Mr. A. Gibson showed mosquitoes in their larval stage, and spoke of the life-history of these insects.

There was no excursion on Saturday, May 18th. The steamer on Lake Deschenes was not yet running, and the boat-trip had to be cancelled, and as it was tag-day for the city hospitals it was decided to omit the excursion altogether.

There was no excursion on Saturday, May 25th, the day after Empire day.

E.H.B.

THE OCCURRENCE OF OSTREA IN THE PLEISTOCENE DEPOSITS OF THE VICINITY OF MONTREAL.

BY EDWARD ARDLEY, PETER REDPATH MUSEUM, MCGILL
UNIVERSITY.

Sir William Dawson in his list of Pleistocene Fossils published in his volume entitled "The Canadian Ice Age," records that he collected a loose specimen of *Ostrea virginiana* at Saco. This he states was apparently derived from the Leda Clay, and he also states that he had received from Mr. Paisley specimens of the same species which had been found at the Baie des Chaleurs, and which were also said to have come from the Pleistocene Beds in that district at a depth of 16 feet below the surface.

The late Mr. E. T. Chambers, some years ago, presented to the Peter Redpath Museum of McGill University, a specimen of *Ostrea* which he had collected at Beauport, Quebec, and which he believed had been derived from the Pleistocene of that locality.

During the present summer the writer has collected Pleistocene Fossils from the Leda Clay and Saxicava Sand, exposed in an excavation made for a drain in the Town of De Lorimier, near Montreal, found at a depth of 9 feet below the surface specimens of *Ostrea* associated with *Mya truncata*, *Macoma calcarea*, *Astarte*, *Laurentiana* and *Saxicava rugosa*, this last mentioned species being found in great numbers. This occurrence in the vicinity of Montreal proves definitely that this genus occurs in the Pleistocene Molluscan Fauna in the extreme western portion of the Province of Quebec.

A FEW DAYS' WORK AND PLAY IN CANADA.

BY E. P. VAN DUZEE, BUFFALO, N.Y.

In late June and early July, 1912, I had occasion to attend a meeting of the American Library Association at Ottawa and improved the opportunity to do a little collecting for Hemiptera about the city and to meet a few of my entomological friends there. At the Central Experimental Farm I found Dr. Hewitt, Mr. Arthur Gibson and Mr. Germain Beaulieu and later had the pleasure of taking two very profitable collecting trips with Mr. Wm. Metcalfe. Our first trip was to Beaver Meadow, near Hull, and on the next day he piloted me to a still better collecting ground at Blueberry Point, near Aylmer. At Hull, I was particularly pleased to take a fine series of both sexes of my new *Criocoris canadensis*. These were swept from grass on the dryer meadows in considerable numbers. On a damper weedy spot I found several examples of a *Lygus* allied to *tenellus* and *fasciatus* which I believe to be still undescribed. It occurs rarely at Buffalo, but I have seen numbers taken by Mr. Metcalfe at Ottawa, and by Mr. Moore at Montreal. Other captures interesting to me were *Microphylellus modestus* Reut. in a good series from grassy lowlands, *Tropidosteptes canadensis* Van D. from an ash tree, and *Athysanus chlamydatus* described as a *Deltocephalus* by Provancher and later as *Thamnotettix infusca* by Gillette and Baker. I was also pleased to obtain here a typical specimen from its type locality of *Gypona hullensis* Prov. which had previously been described as *pectoralis* by Spangberg. *Labops hesperius* Uhler was common here as it is everywhere in eastern Canada and northern New York and New England. I secured a single specimen of *Dichrooscytus elegans* Uhler from a cedar tree and Mr. Metcalfe pointed out to me that the plants of a *Senecio* which was abundant there were infected by a pretty fulvous Psyllid new to me.

Our work next day was done under entirely different conditions. The ground was very dry in the open woods at Blueberry Point, but I took a few very interesting species, chief of which was a series of four specimens of *Amblytylus 6-guttatus* Prov., an elegant little velvety-black Capsid with olive head and three conspicuous white spots at the tip of each elytron, the anterior of which was pale yellow in one of my examples. It was the first time I had ever seen the species, which appears to be a *Macrotylus* and is probably very local in its distribution. Here I also took several specimens of Bank's recently described *Pindus audax*, a species I have long known from western New York.

I again visited this locality on July 3rd, working then on

the dryer fields outside the woods and was delighted at finding four examples of an undescribed *Spherobius* quite new to my collection although if my memory is not at fault I have seen one specimen in some collection sent to me for names. Here also I took large numbers of my *Criocoris canadensis* and on the dryer knolls found *Oncotylus punctipes* Reut. in great numbers and *Mimoceps gracilis* on the sedges.

On July 2nd I went to Chelsea for a day as the guest of Mr. Gibson, where I found conditions quite different. My first surprise was to find *Stenotus binotatus* Fabr. in great abundance in the grassy openings in the woods. Another common species was a *Strongylocoris* of which I had seen a few specimens but which I have not yet been able to determine. *Laccocera vittipennis* VanD. was abundant here as it is everywhere in the more stoney regions of Canada and New England. *Philaronia bilineata* Say was taken here in company with the ubiquitous *Philænus lineatus* Linn., a species which seems to be spreading slowly westward and I fear in time may prove a real pest. It has long been common in northern New England and New York but has only recently reached Buffalo, where it is still rare. Along the Gattineau River I secured a fine series of *Oncopsis variabilis* Fh. and a few *sobrius*, *fenestratus* and *pruni*. *Pæilocapsus dislocatus* was common here and presented one or two fairly distinct varieties which I had never before seen.

On the 4th I did a little work in a swampy wooded pasture, by the trolley track beyond Rockcliffe Park and was lucky enough to obtain from the willows there four examples of a *Lygus* near *pratensis* which is entirely new to me unless it prove to be a very dark form of *rubicundus* Fallen. *Macropsis viridis* Fh. was very common here and was pairing as was also *canadensis* VanD. I was surprised to find that the black males of these two species were absolutely indistinguishable and I believe *canadensis* will prove to be but a dimorphic form of the female *viridis*. I might add here that unfortunately we must change the generic names in this family so *Pediopsis* becomes *Macropsis*, the old *Bythoscopus* becomes *Oncopsis* and our *Macropsis* must hereafter be *Bythoscopus*.

On July 5th I went on to Quebec for the purpose of studying the Provancher collection of Hemiptera now in the Museum of Public Instruction there. Rev. V. A. Huard very courteously gave me free access to the collection and did everything possible to assist me in my work. A report on my study of this collection will probably appear in an early number of the *Canadian Entomologist*.

Returning, I stopped off at Montreal for a day's visit with Mr. G. A. Moore, who showed me his excellent collection of local

Hemiptera and piloted me to an interesting collecting ground on Mount Royal. I was delighted to take here a fine series of *Tropidosteptes palmeri* which Reuter now places as a variety of *amoenus* but which I believe will prove to be a distinct species. With these I also took *T. pettiti*, *amoenus* and *canadensis*, and one example of *Lygidea rubecula* Uhler from what I took to be a wild plum tree. My little *Criocoris canadensis* was common here as was also *Philænus spumarius* with which I took its variety *leucocephala* Linn. described as *albiceps* by Provancher.

Altogether I found this a very pleasant and profitable trip and one I will long remember with pleasure.

UNUSUAL NESTING SITE OF THE PIGEON HAWK IN NEWFOUNDLAND.

BY W. J. BROWN, WESTMOUNT, QUE.

Various situations are chosen by the Pigeon Hawk for nesting purposes. For instance, sets of eggs of this species have been found in holes in trees and banks, in deserted nests of crows, on cliffs along the sea coast, etc., and occasionally the bird is not averse to building a well constructed nest in a tree in deep woods. In certain portions of Newfoundland owls, hawks and crows are not plentiful, consequently, old nests are seldom met with.

Some distance up the Reid-Newfoundland Railway there is a large tableland, or topsail (the latter term being applied by the residents), at the base of which an extensive area of thick spruce woods is located. While passing along the edge of this timber on June 6th, 1912, an anxious male Pigeon Hawk flew in circles over my head, cackling incessantly. This was sufficient evidence that a nest was nearby. In a few minutes the female joined in the noisy demonstrations, having apparently just left the nest, but the underbrush was so heavy it was difficult to tell from what direction she had come. After considerable time had been spent in the examination of likely spruces for old nests or cavities, I came to the conclusion that the nest was on the ground. The birds were much attached to a section of dead spruces and rocky ground in the centre of the woods. The male and female, particularly the latter, were diving and screaming a few feet overhead and it was apparent that I was not more than a stone's throw from a well concealed nest. An exhaustive search, however, failed to reveal it. I retired to a large boulder, about two hundred yards away, to give the female an opportunity to return to the nest. In twenty minutes

the birds were quiet and they were evidently satisfied that all cause for disturbance had been removed and that I had left the neighbourhood. Approaching the same locality again as noiselessly as possible, I saw the female flush out of the ground some thirty yards ahead. It only took a moment to find the nest, which contained five fresh eggs. These were laid underneath a decayed spruce stump, a few pieces of bark and some feathers forming the lining. The nesting site was well hidden by a dense growth of stunted spruce, and a large snowbank, several feet deep, was within ten yards of it.

I might here state that the Pigeon Hawk is probably the most curious and inquisitive of the Raptores. The sectionmen on the railway told me that they were always greeted by a pair of Pigeon Hawks when they passed down on the hand car, although the nest was a quarter of a mile off in the woods. My personal experiences with the species in Newfoundland have certainly brought these facts to light. One day in June, 1911, we pitched our camp out on the barrens. A pair of Pigeon Hawks, which had their nest on the side of a mountain one mile away, observed the smoke from our fire and immediately came over our heads, uttering alarm notes. During the second week in June, 1912, near Bay of Islands, my attention was drawn to a male Pigeon Hawk overhead. Five hundred yards further on the female was flushed from a hole, about twenty feet up, in a dead pine. At this time the nest contained three fresh eggs. It can thus be seen that if Pigeon Hawks were less concerned and demonstrative during the breeding season, fewer nests would be found.

BIRD NOTES.

By L. McI. TERRILL, ST. LAMBERT, QUE.

During December, 1911, the weather was exceptionally mild, the considerable fall of snow melting almost as fast as it fell, filling the swamps with water. With the commencement of January, 1912, came a change, with an unusual continuation of very cold weather, almost without a break, lasting until the end of March.

During this period, January 1st to March 31st, practically the only birds noted were winter visitors, such as Redpolls, Snowbirds and Pine Grosbeaks. These birds were more noticeable during March and were all scarce, with the exception of Redpolls during January and February. The Grosbeaks' movements in the vicinity of Montreal were apparently governed

by the supply of Mountain Ash berries. Further north, in the Laurentians, they were better distributed and with the Blue Jay and other permanent residents, such as various woodpeckers, were commonly noted.

During the second week of February I noticed four Snowy Owls in the market and was informed that they had been shot at St. Jacques le Mineur, Laprairie County, about the 3rd of February.

The first migrants to appear were a few Crows and Prairie Horned Larks on March 10th.

Good Friday, April 5th, was the first truly springlike day, but still little sign of the delayed migration. The following day, however, brought several arrivals, the Song Sparrows being conspicuous. I had not the leisure for an extended walk until the 7th, which proved fine in the morning, though a west wind springing up toward noon brought colder weather with heavy showers of rain. In the early morning I heard several species singing from my window, the songs becoming more frequent about 6 o'clock, when a Phoebe joined the chorus of Song Sparrows, Juncos and Robins. During a six hours' walk, from 8 a.m. to 2 p.m., covering swampy and upland fields, river shore and edge of woods, the day revealed an unusual mixture of early and late arrivals. Though in the locality visited, Isle Jesus, Laval County, most of the fields were still covered with snow, many Prairie Horned Larks had commenced nesting, several nests being found in places where the snow had disappeared. These were in various stages of construction; one, a large saucer-shaped cavity, recently excavated, contrasted strongly with the small deep interior of a thick-walled completed nest.

Following is a summary of migration to date, the 8th of April:—

- March 10. Crow—ten seen.
Prairie Horned Lark—twelve seen.
- March 31. Pigeon Hawk—one seen.
Red-shouldered Hawk—one seen.
- April 5. Bronzed Grackles—one flock seen.
- April 6. Song Sparrow—numerous and singing.
Savannah Sparrow—six seen.
Slate Colored Junco—one flock, 4 or 5 birds.
Robin—fairly common, heard singing.
- April 7. Duck, sp.?—flock of 25 in open water of Riviere des Prairies, continually shifting position possibly on account of floating ice.

- April 7. Kildeer Plover—well distributed in pairs throughout their accustomed haunts.
 Red-shouldered Hawk—commonly seen and heard.
 Sharp-shinned Hawk—one seen in erratic flight.
 Crow—flocks disbanded, commencing nesting operations.
 Red-winged Blackbird—commonly noted.
 Cowbird—two seen following flock of Grackles, four others noted later.
 Meadowlark—common, about 15 seen and heard.
 Prairie Horned Lark—commonly in song, five nests noted.
 Phoebe Flycatcher—well distributed in pairs, about ten noted.
 Snowbird—one mixed flock of Lapland Longspurs and Snowbirds watched for ten minutes in a continuous and almost circular flight, at length alighting in a ploughed field, the occasional tremulo of the Snowbird contrasting with the single note of the Longspur.
 Lapland Longspur—seen with Snowbirds.
 Redpoll—many large flocks noted.
 Song Sparrow—abundant, singing constantly during sunshine and rain.
 Savanna Sparrow—one in song, about 20 noted in small flocks.
 Vesper Sparrow—commonly noted, several singing from tops of hedge-row trees.
 Tree Sparrow—two heard singing, apparently the bulk has not yet arrived.
 Slate Colored Junco—common, numbers singing.
 Migrant Shrike—one seen in flight.
 White-bellied Swallow—two seen in flight about a boggy willow swamp, marked by a few dead ash stubs, probably their selected nesting-site.
 House Wren—one pair noted in woodpile near farmhouse.
 Robin—fairly common, a few in song.
 Bluebird—numerous.

AVERAGE TEMPERATURE.

April 1st	was	21°	Far.,	wind	N.E.-S.E.,	with snow at night.
"	3rd	"	27°	"	"	N.-N.W., snow in morning.
"	4th	"	26°	"	"	N.W.-S.W., fair.
"	5th	"	39°	"	"	high S.W.-W., a little snow.
"	6th	"	46°	"	"	S.W.-N.W., fair.

April 7th was 44° Far., wind S.W.-N.W., heavy rain in afternoon
coming with strong
westerly wind.

“ 8th “ 24° “ “ N.W., snow flurries.

OBITUARY.

REV. GEORGE W. TAYLOR, F.R.S.C., NANAIMO, B.C.

In the death of the Rev. George W. Taylor, on August 22nd, Canadian zoology loses one of its most distinguished workers. To a great many of his friends in eastern Canada, especially in Ottawa, the announcement must have come with a shock of surprise, for when last in the Capital, five years ago, attending the Royal Society meetings, as a Fellow, he was full of vigour and activity. He received something like an ovation from his brother scientists here, as his visits, owing to his residence on the Pacific coast, were of rare occurrence. With his great friend, the late Dr. James Fletcher, he spent much time on his last visit, but he had hosts of other friends who were delighted to see him once more in Ottawa. Born in Derby, England, in 1854, he became connected with the excellent Natural History Museum in that busy railway centre, and acquired a reputation as an original observer, but on coming to Canada in 1882 he applied himself, with such vigour and success, to work in conchology and entomology that he soon took a first place as an authority; his collections of land and freshwater shells, and of marine mollusca, and his collection of N. A. Geometridae are amongst the finest in existence.

As a clergyman of the Church of England much of his time was taken up with parish work in Ottawa, Ont., and in Victoria, Nanaimo, and Wellington, B.C., but he never abated in his devotion to scientific studies. For some years he gave up clerical work, and resided in a lovely but lonely spot at the north end of Gabriola Island, in the Straits of Georgia, in order to investigate the marine zoology of the nearby marvellously rich waters, and in the hope that a biological station would be founded there by the Dominion Government. This long cherished ambition was at last gratified when, in 1909, laboratory buildings were erected at Departure Bay, and the Board of Management, composed of professors in the chief universities of the Dominion chose him as the first curator, a position he held until his death. He threw himself with all his energy into his new duties, and by constant dredging expeditions and shore collecting accumulated a vast collection of marine fishes and invertebrates,

which excited the wonder of a party of British and foreign scientists, who paid a visit to this British Columbia Station in September, 1909, at the close of the meeting of the British Association in Winnipeg. The party included famous men from the British Museum, from Cambridge University, Copenhagen, Sheffield, Leeds, London and other universities, and like President Starr Jordan, Professor C. H. Gilbert, and Dr. Barton Evermann, who made short visits to the station, they declared it to be one of the best marine laboratories on the continent. The location is very beautiful, but the rich marine life in the waters of Departure Bay, and above all, the enthusiasm and profound knowledge of the curator himself, delighted all scientific visitors.

Those privileged to go with him on dredging trips will not soon forget his scientific devotion. The writer sailed with him, in 1906, on the Dominion cruiser "Kestrel," along the British Columbia coast from Vancouver to Alaska, including Queen Charlotte Islands and Quatsino Sound in the cruise, and at every point where hauls of the dredge were made myriads of strange creatures were brought up from the depths below. From morning to night Mr. Taylor sorted out and named the specimens, usually working on deck till long after dark, aided by the light of a ship's lantern. He had such an unusual knowledge of marine zoology that he could name without difficulty a vast proportion of the hosts of molluscs, echinoderms, zoophytes, etc., and very fine collections resulted. He was for some time at work on a list of small shore fishes, so abundant in British Columbia, but the list was never completed. It included many new forms. One named *Asemichthys taylori* has been described in a paper, now being printed by the King's Printer, Ottawa, the author being the eminent United States ichthyologist, Professor C. H. Gilbert, Stanford University, who says, "I take pleasure in naming this interesting species for its discoverer, Rev. G. W. Taylor, Nanaimo, B.C." A list of British Columbia Copepod Parasites is also now in course of publication by the Biological Board, the result of Mr. Taylor's assiduous collecting, and the author, Professor C. B. Wilson, the well-known specialist, says that eight out of fourteen species are wholly new to science. Mr. Taylor made a study of Pacific Crustacea, and completed a report, to be issued shortly, by the Biological Board, with the title "Preliminary List of One Hundred and Twenty-nine Species of British Columbia Decapod Crustaceans." In the report of the British Columbia Fisheries Commission, of which Mr. Taylor was appointed a member by the Dominion Government, he gave a list of no less than thirty species of edible molluscs occurring on the British Columbia coast, of which three only,

the oyster, the clam, and the abalone or *Haliotis*, are at present used for food.

It would take many pages to tell of his numerous papers contributed to scientific journals, from the time of his early papers in the *Nautilus*, and later in the *Canadian Entomologist*, and especially in THE OTTAWA NATURALIST, which for nearly twenty years he has enriched with able notes and papers. One of general interest is a sketch of Canadian Conchology (March, 1895), an admirable summary with a valuable bibliography of the principal papers on the subject. He made many additions to our molluscan fauna, such as the two land shells, *Punctum clappii* and *P. taylori*, the latter being new to science, and named by Dr. Pilsbery after him.

His splendid entomological labours which brought him into contact with leading authorities in France, Germany and Britain, as well as in this continent, will be adequately treated elsewhere, but reference may be made to such papers as "Notes for April in Vancouver Island," published in these pages in 1898, in which he told of forty species of Coleoptera secured in an afternoon walk, besides Cicadas, and specimens of Lepidoptera, Hymenoptera and Orthoptera, some of them rare. A valuable list of Pacific Marine Mollusca, covering over eighty pages of the Royal Society's Transactions, 1895, must not be omitted; but it is not possible to name, even by title, the many scientific contributions bearing this indefatigable worker's name.

He was chosen a member of the Biological Board of Canada, and was a Fellow of the Zoological Society of London, and of the Entomological Society of London, while for a time he was an associate editor (in zoology) of THE OTTAWA NATURALIST. He himself especially valued the mark of appreciation on the part of his brother naturalists in Ottawa, when he was chosen as a Corresponding Member of the Ottawa Field-Naturalists' Club.

High as was his rank amongst entomologists, he held a hardly less eminent position amongst marine biologists and conchologists, but he was also well versed in botany and geology, and his mathematical abilities were such that had he gone to Cambridge University, as in early life was intended, he would have, without doubt, gained high academic distinction in the mathematical tripos. His genial personal qualities and his self-denying devotion to science, especially work in the field and at sea, attracted all who were privileged to know him. Numerous as are his scientific papers, his labours and influence cannot be adequately measured by them.

E. E. PRINCE.

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ON TWO NEW PALEOZOIC STARFISH (ONE OF THEM FOUND NEAR OTTAWA), AND A NEW CRINOID.

BY PERCY E. RAYMOND.

PALÆASTER? WILSONI, SP. NOV. Plate V.

The remarkable starfish found by J. E. Narraway, Esq., at City View, near Ottawa, and described by Professor Hudson in the May and July numbers of THE OTTAWA NATURALIST as *Protopalæaster narrawayi*, naturally excited interest in City View as a collecting place. Specimens like Mr. Narraway's, which can be described as *order*, *family*, *genus* and *species nov.* are of infrequent occurrence, but such a discovery shows that the possibilities of even so old a collecting place as Ottawa are by no means exhausted.

In searching for another specimen similar to the one found by Mr. Narraway, Miss A. E. Wilson was fortunate enough to find a pretty starfish of a type hitherto quite unknown in strata so old as the Black River. The specimen is exposed from the abactinal side, and preserves the greater part of one arm, the disk, and the stumps of the other four arms. The diameter of the specimen, when complete, must have been about 75 mm. (3 inches), and the diameter of the disk is 20 mm. This is large for a starfish from the lower Ordovician. The arms are quite convex, with a gentle taper, reminding one somewhat of the common recent starfish, *Asterias vulgaris*, and as in that species, the arms were probably somewhat flexible. The greater part of the abactinal side of the disk and arms is covered with small convex, over-lapping, V-shaped plates, which are arranged with the point of the V directed toward the margins. Along the crest of each arm there is a single row of larger plates. These plates are quite large and hexagonal in outline near the disk, but become smaller, triangular, and alternate in position further out on the arm. (See upper right-hand figure on the plate). There are two rows of marginals, these plates being larger and flatter than the other plates, and covered with minute tubercles, which may be spine-bases. (See the middle figure on the plate). Close to the disk, the supra-marginals and mar-

ginals seem to be of the same size; both rectangular, and the plates of the supra-marginal row directly over those of the marginal series. Further out on the arms, the plates are pentagonal, those of the two rows alternating in position, and dove-tailing, and the supra-marginals are smaller than the marginals. One of the marginals, about half-way out on the arm, is 1.25 mm. high and of about the same breadth. The smaller triangular plates which cover the greater part of the arm average about .5 to .6 mm. in height. On one of the arms (the one directed downward in the upper left-hand figure on the plate), the small triangular plates seem to be arranged in rows parallel to the axis of the arm, but the plates on the longer arm seem to be more irregular, although a general arrangement in rows can be seen. On this arm there are a number of very small plates scattered about, especially on the top of the arm, thus adding to the irregularity. The triangular shape of these plates gives the arm a neat pattern, the plates making diagonal rows backward and forward from the row of large plates along the top of the arm. The madreporite, which is nearly circular in outline, and 2 mm. in diameter, is in position, but slightly tipped down at the inner side, in an interradius, and not far from the centre of the abactinal side of the disk. The surface is probably worn, for it appears perfectly smooth.

In the fragment of the arm which is directed upward in the upper left-hand figure and in the lowest figure on the plate, the small plates are broken away, disclosing the ambulacral plates. These plates, which are long and rather thick, seem to be alternate in position. Two of the plates, well shown in the lower figure, and indicated by an arrow, seem to be pierced by pores near their proximate ends, two pores piercing each plate vertically. Near the outer end of the more perfect arm there is a space where a few of the small triangular plates are missing, and here also the ambulacral plates can be seen from the upper side. Each plate has a narrow keel on that side. (See the middle figure on the plate, between the two brachiopods). Other details of the plates of the actinal side are unknown.

This species seems to be most nearly related to *Palæaster magnificus* Miller,* to which species my attention has been called by Professor Schuchert, who has most kindly loaned me photographs of the type. *Palæaster? magnificus* is a large starfish (6 inches in diameter), found in the Waynesville division of the Richmond formation in Ohio. Like *Palæaster? wilsoni*, it has two rows of large marginals and a row of large plates

*Jour. Cincinnati Society Nat. Hist., vol. 7, p. 16, pl. 4, figs. 3, 3a, 1884.

along the top of each arm, while the greater part of the surface is covered with small convex triangular plates. Miller found the plates to be spine-bearing, a point which can not be definitely decided in the present species. From the photograph it appears that there are spaces between the small triangular plates on the abactinal surface in *Palæaster? magnificus*, while in *P.? wilsoni* these plates actually overlap each other.

There is a superficial resemblance between *Palæaster? wilsoni* and *Urasterella pulchella* (Billings), but the latter species does not have the double row of marginal plates, nor the large plates along the top of the arm. The arms are also much more slender in Billings' species.

Of course the reference of this species to *Palæaster* is purely a convention, as it has nothing in common with the type of the genus. The generic position of these starfishes will be discussed in the monograph by Professor Schuchert, which it is expected, will appear at an early date.

Locality and formation. The holotype was found by Miss A. E. Wilson in a fence near the large quarry in the Lowville formation at City View, a short distance south-west of Ottawa. While the Lowville is the only formation which is exposed at this particular spot, the starfish seems to have been derived from the Black River, which outcrops only a short distance away. The matrix contains, beside the starfish, *Rhynchotrema inæquivalve* (shown in the photograph), *Orthis tricenaria*, and *Rafinesquina alternata*. The species is dedicated to its discoverer, whose private collection contains the type.

GENUS MARIACRINUS HALL.

MARIACRINUS? INSUETUS, SP. NOV.

Mariacrinus sp. Raymond, 1907. American Journal of Science, Fourth Series, Vol. XXIII, p. 118.

Two fragmentary calices of crinoids from the Three Forks Shale at Logan, Montana, are of importance, as they are the only crinoids thus far known from the Devonian of the Rocky Mountains. These fragments were sent to Mr. Frank Springer for identification, and he reported that they probably belonged to the genus *Mariacrinus*.

One fragment (Figure 1) retains the base of a calyx and fragments of four radials. All sutures are obliterated, but the ornamentation makes possible the determination of the probable outline of the plates. From such parts as remain, the radials seem to have been in contact. The position of the two notches in the margin of the area of stem attachment suggest that there are four basals, though there may be only three, two large and one small. The ornamentation consists of raised lines

which connect the centres of the plates, forming a series of triangles.

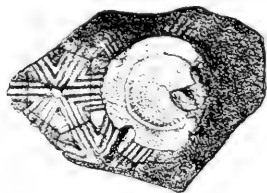


Figure 1 x 2.

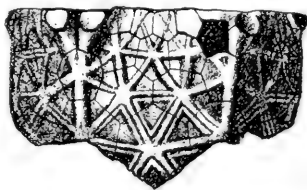


Figure 2 x 2.

The other specimen is a part of the dorsal cup, lacking the basal portion. Figure 2 shows this fragment, the ray lacking the distichial being the anterior radius. The rays show a strong longitudinal ridge crossing the first costal and bifurcating near the centre of the second, sending a branch onto each of the distichials. This species appears to agree with *Mariacrinus warreni* from the Niagara in having only two distichials, and no palmers in the calyx. In fact, none of the rays show more than one cycle of distichials, but there were probably two when the specimen was complete.

The interradiar areas are not depressed as in most species of this genus, a section through the calyx at the second cycle of interbrachials being almost circular in outline. There is, however, a slight depression in the interdistichial spaces. The first interbrachial is large, the next two slightly smaller. The three plates of the third series and the four of the fourth are not regularly hexagonal, but laterally compressed. The posterior interradius is very badly preserved, but there appear to be five interbrachials in the third row. As shown in the figure the plates are ornamented with raised lines connecting the centres of the plates.

Locality.—The specimens were found by the writer in the limestone of the Three Forks Shale at Logan, Montana, associated with the fossils of the brachiopod facies of the *Clymenia americana* fauna. The types are in the Carnegie Museum, Pittsburgh, Penna.

GENUS SCHÆNASTER MEEK AND WORTHEN.

SCHÆNASTER? MONTANUS SP. NOV.

Animal small, about an inch in diameter. Rays short, slender, extending about one-half their length beyond the disk. Disk large, pentagonal, the margin slightly concave between the rays. The five proximal plates of the adambulacreal series function as orals, while on the arms beyond the disk the adam-

bulacreals become marginals. The adambulacreal plates are rather small, oval, placed with the long axis diagonal to the axis of the arm. On the most perfect arm there are 16 of these plates on each side of the groove, not counting the proximal and distal plates.

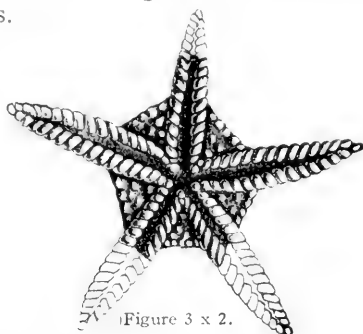


Figure 3 x 2.

The ambulacreal ossicles are small, arranged alternately. On this specimen they are mostly displaced. The plates on the disk between the rays are few and small. The marginals are small, rounded, and do not appear to bear spines, but this appearance may be due to poor preservation.

Locality.—This species is described from a single specimen collected by the writer in the Madison Limestone at Spring Canon in the Ruby Mountains, near Alder, Montana. The type is in the Carnegie Museum, Pittsburgh, Penna.

EXPLANATION OF PLATE.

1. Upper left-hand figure. *Palæaster? wilsoni* Raymond. All that is preserved of the specimen. The brachiopods are *Rhynchotrema inæquivalve*. One-half larger than natural size.

2. Upper right-hand figure. An enlargement of the ray which extends downward to Fig. 1, to show the character of the large plates along the top of the arm. X 3.

3. Central figure. The most perfect arm, viewed from the side. Notice the two rows of large marginals, the overlapping triangular plates above them near the middle of the arm, and the flatter and more nearly square plates to the right, nearer the disk. X 3.

4. Lower figure. An enlargement of part of the specimen, to show the ambulacral plates in the ray pointing upward, the madreporite, and the small, irregular plates along the top of the arm. The arrow points to the two ambulacrals which are pierced by vertical pores. X 3.

All the photographs were made at the Geological Survey of Canada, and are published by permission of the Director.

CONSTITUTION OF THE OTTAWA FIELD-
NATURALISTS' CLUB.

ARTICLES OF THE CONSTITUTION.

- I. Name.
- II. Objects or Aims.
- III. Membership.
- IV. Annual Fees.
- V. Officers.
- VI. The Council.
- VII. Auditors.
- VIII. Meetings.
- IX. Order of Business at the Annual Meeting.
- X. Elections.
- XI. Term of Office.
- XII. Vacancies.
- XIII. Quorum.
- XIV. Duties of Council.
- XV. Duties of President.
- XVI. Duties of Vice-President.
- XVII. Duties of Secretary.
- XVIII. Duties of Treasurer.
- XIX. The Ottawa District.
- XX. The Ottawa Naturalist.
- XXI. Amendments.

ARTICLE I. NAME.

This club shall be known as "THE OTTAWA FIELD-NATURALISTS' CLUB."

ARTICLE II. OBJECTS.

The objects of this Club shall be: To foster an acquaintance with and a love for nature; to study especially the natural history of the Ottawa District; to encourage investigation and to publish the results of original research in all departments of natural history; to arrange for out-of-door excursions during the summer months; to provide free lecture courses during the winter months; and in a general way to render assistance to students or others interested in Nature Study.

ARTICLE III. MEMBERSHIP.

(a) ACTIVE. Any one interested in Natural History may upon application be elected by Council as an active member of the Club. Payment of the annual fee shall be a necessary condition of the continuance of membership.

(b) CORRESPONDING. Any eminent naturalist not resi-

dent in the Ottawa District, who is desirous of promoting the objects of the Club, may be elected by the Council as a Corresponding Member.

(c) HONORARY. Any prominent person resident of the Ottawa District, who shall to a marked degree assist towards the successful working of the Club, may be elected by the Council as an Honorary Member. There shall not be at any one time more than five such Honorary Members.

The Council shall also have power to elect a Patron after his consent has been obtained. The Patron shall be considered one of the Honorary Members.

(d) No Membership fee shall be expected from Corresponding or Honorary Members.

ARTICLE IV. ANNUAL FEE.

The annual membership fee shall be one dollar, payable in advance immediately after the Annual Meeting. No member in arrears shall be entitled to any of the privileges of the Club.

ARTICLE V. OFFICERS.

The officers of the Club shall be a President, a First and a Second Vice-President, a Secretary, a Treasurer, an Editor and a Librarian.

By decision of the Club or of the Council, two officers may, if necessary, be filled by one person for one year.

ARTICLE VI. THE COUNCIL.

The Council shall consist of not less than fifteen members, namely, the officers and at least eight other active members of the Club. Upon retirement of any President of the Club from office, he shall, if still resident in the Ottawa District, continue a member of the Council for the ensuing Club year.

ARTICLE VII. AUDITORS.

The Auditors shall be elected by open vote at the Annual Meeting. They shall examine the Treasurer's accounts and certify as to its correctness.

ARTICLE VIII. MEETINGS.

(a) The Annual Meeting of the Club shall be held on the third Tuesday of March, the anniversary of the inauguration of the Club in 1879.

(b) Special Meetings of the Club may be called by the Council or shall be called by the Secretary on the request of ten active members. At this meeting no business other than that for which the meeting was called shall be transacted except by unanimous decision of those present.

(c) All questions submitted for discussion at the meetings of the Club shall be in harmony with the expressed objects of the Club. The mover of a resolution shall be allowed ten minutes to speak in presenting his motion. Five minutes shall be allowed each of the subsequent speakers, and to the mover in closing the discussion.

ARTICLE IX.

ORDER OF BUSINESS AT THE ANNUAL MEETING.

1. Reading the minutes of the previous Annual Meeting and of any special meetings held during the year.
2. Business arising out of the minutes.
3. Communications.
4. Report of the Council.
5. Report of the Treasurer.
6. Reports of Special Committees.
7. Election of members of the Council.
8. Election of Auditors.
9. Notices of motion.
10. New Business.
11. Suggestions for the good of the Club.

ARTICLE X. ELECTIONS.

The President, the two Vice-Presidents, the Secretary, the Treasurer, and the eight non-official members of Council, shall be elected by ballot at the Annual Meeting.

The Council as so constituted (including the past-President, if any), shall at the earliest possible date, select and appoint the Editor and the Librarian either from among its own number or from the members of the Club at large.

If after these appointments the members of Council shall still be found to number fewer than fifteen, as prescribed in Art. VI., Council shall similarly select and appoint one or more additional members to complete such full quota.

None but active members of the Club shall be eligible for any of the above elections or appointments.

ARTICLE XI. TERM OF OFFICE.

The officers, the other members of the Council, the auditors and the associate editors shall hold office during the year following the Annual Meeting, or till their successors are appointed.

ARTICLE XII. VACANCIES.

The Council shall have power to accept any resignations and to appoint any active member of the Club to fill any vacancy occurring during the Club year.

ARTICLE XIII. QUORUM.

Twenty members shall constitute a quorum at the Annual Meeting or any other business meeting of the Club, and five members shall constitute a quorum of the Council.

ARTICLE XIV. DUTIES OF THE COUNCIL.

The Council shall, as business may require, meet from time to time at the call of the President or of any two other of its members; it shall manage all matters affecting the welfare of the Club; it shall have full control of the funds of the Club, and it shall present at the Annual Meeting a report upon the year's work.

ARTICLE XV. DUTIES OF THE PRESIDENT.

The President shall preside at all lectures, excursions and other meetings of the Club. He shall be chairman at the meetings of the Council. He shall conduct all business of the Club in accordance with its Constitution and By-laws. He shall be, ex-officio, a member of all committees of the Council and of the Club.

ARTICLE XVI. DUTIES OF VICE-PRESIDENTS.

In the absence of the President, or at his request, a Vice-President shall, in order of rank, preside.

ARTICLE XVII. DUTIES OF THE SECRETARY.

The Secretary shall keep a true record of the proceedings of the Club and of the Council, and shall conduct their correspondence. He shall give previous notice to each member of the Council of its various meetings. He shall be responsible for all newspaper notices of all lectures and excursions. He shall be the custodian of the Constitution and By-laws and the records of the Club. He shall prepare reports of the meetings of the Council for THE OTTAWA NATURALIST. He shall be compiler of the Annual Report of the Council and shall read it at the Annual Meeting of the Club.

ARTICLE XVIII. DUTIES OF THE TREASURER.

The Treasurer shall be charged with the collection and custody of the moneys of the Club and shall keep a systematic account thereof which shall at any time be open to the inspection of the Council or of the Auditors. He shall submit at each Annual Meeting a statement showing the financial standing of the Club. He shall make disbursements only when authorized by the By-laws or by decision of the Council. He shall be, ex-officio, a member of the Excursions Committee.

ARTICLE XIX. THE OTTAWA DISTRICT.

The Ottawa District shall be the area included within a radius of thirty miles from the City of Ottawa.

ARTICLE XX. THE OTTAWA NATURALIST.

THE OTTAWA NATURALIST is the organ of the Club. It shall, if possible, be issued before the tenth day of each month, and a copy be sent to every member of the Club. The Editor shall be elected by the Council, nominations being made by ballot. The Associate Editors shall also be appointed by the Council, but each division (department) of the Club shall have the privilege of nominating one or more persons. All contributions published in THE OTTAWA NATURALIST shall be in harmony with the objects of the Club, the decision of the Publications Committee on such matters being final.

ARTICLE XXI. AMENDMENTS.

An amendment to this Constitution may be passed at an Annual Meeting of the Club by a two-thirds vote of the members present, notice having been given at a previous Annual Meeting or to the Council at least two months previous to such Annual Meeting. Notification of a proposed amendment shall be published in THE OTTAWA NATURALIST in the month of February.

BY-LAWS.

1. Standing Committees.
2. Publications Committee.
3. Duties of Publications Committee.
4. Duties of the Librarian.
5. Duties of the Editor.
6. Duties of the Associate Editors.
7. Duties of the Excursions Committee.
8. Leaders at Excursions.
9. Duties of Lectures Committee.
10. Departments.
11. Order of Business at Meetings of Council.
12. Amendments.

NO. 1. STANDING COMMITTEES.

Three Standing Committees of at least five members each shall be appointed by the Council from among its members, viz.: a Publications Committee, an Excursions Committee, and a Lectures Committee. The names of the members of each committee shall be printed in order of their rank, on the cover of THE OTTAWA NATURALIST.

NO. 2. PUBLICATIONS COMMITTEE.

The Publications Committee shall be composed of the Editor, the Librarian, and three other persons selected by the Council from among its members.

NO. 3. DUTIES OF THE PUBLICATIONS COMMITTEE.

The Publications Committee shall have direct supervision over all publications issued or received by the Club and shall see that they are dealt with by the Librarian in accordance with By-law No. 4.

This Committee shall have power to decide what shall and what shall not be published in THE OTTAWA NATURALIST and shall see that the Editor performs his work in accordance with By-law No. 5.

The Chairman of this Committee shall submit to the Council a report which shall be embodied in the Annual Report of the Council. This report shall give an outline of the work accomplished by the Committee during the year, and shall also include the report of the Librarian provided for in By-law No. 4.

NO. 4. DUTIES OF THE LIBRARIAN.

The Librarian, under the direction of the Publications Committee, shall have charge of all exchanges and volumes belonging to the Club. He shall keep a record of these and shall make such disposition of them as will render them easily accessible to the members of the Club. Towards the close of each Club year, and in time for embodiment in the annual report of the Publications Committee, he shall submit to said Committee a detailed statement of the publications received, the titles of the volumes bound during the year, the names of the volumes added to the Library of the Club, the number of copies of THE OTTAWA NATURALIST kept in reserve, and such other relevant information as he may consider of value and interest.

NO. 5. DUTIES OF THE EDITOR.

The Editor shall be responsible for the preparation of THE OTTAWA NATURALIST, which he shall endeavor to issue before the tenth day of each month. He shall be an ex-officio member of the Publications Committee, whose executive officer he shall be and to whom he shall be responsible. He shall also be Chairman of the Editorial Committee, composed of the Editor and the Associate Editors.

NO. 6. DUTIES OF THE ASSOCIATE EDITORS.

The Associate Editors shall co-operate with the Editor in his work of preparing THE OTTAWA NATURALIST. They shall

render advice and assistance to him when he finds it necessary to consult them. The Associate Editor of each division (department) shall be responsible to the Editor for a report of each meeting held by the Branch of which he is the representative.

NO. 7. DUTIES OF THE EXCURSIONS COMMITTEE.

The Excursions Committee shall from time to time make arrangements for field work, subject to the approval of the Council. It shall submit a signed report to the Council outlining the work done at the excursions during the past season. The chairman of this Committee shall be responsible for a report of each excursion for publication in THE OTTAWA NATURALIST.

NO. 8. LEADERS AT EXCURSIONS.

The Leaders at Excursions are persons appointed by the Council to lead parties interested in the various phases of natural history in connection with the regular excursions of the Club. The person whose name appears first as Leader in any department shall assume the responsibility of providing a Leader in his department at each excursion.

NO. 9. DUTIES OF THE LECTURES COMMITTEE.

The Lectures Committee shall prepare a lecture programme before November of each year and submit it for approval to the Council. Its members shall constitute a Reception Committee at the various lectures.

The Chairman of this Committee shall be the custodian of the programmes; he shall be responsible to the Editor for a report of each lecture; and he shall at the close of each year submit a signed report to the Council outlining the work accomplished under the supervision of this Committee. This report shall be embodied in the Annual Report of the Council.

NO. 10. DEPARTMENTS.

The Club recognizes the following departments of natural history: Archaeology, Botany, Entomology, Geology, Ornithology, Zoology.

Members may form groups for intensive study in the departments in which they are respectively interested.

Each department shall have the privilege of nominating one or more of its members as Associate Editors, such nominations being submitted to the Council of the Club.

NO. 11. ORDER OF BUSINESS AT MEETINGS OF COUNCIL.

1. Reading minutes of previous meeting.
2. Business arising out of minutes.

3. Communications.
4. New Members.
5. Reports of Committee.
6. New Business.

NO. 12. AMENDMENTS.

An amendment or an addition to these By-laws may be passed at any meeting of the Council, by a two-thirds vote of the whole Council, due notice embodying a copy of the proposed motion having been given at a previous meeting of the Council. Any such amendment or addition shall be published in the next issue of THE OTTAWA NATURALIST.

DONATIONS TO THE NATIONAL MUSEUM.

The Victoria Memorial Museum has received a gift from the Canadian Northern Pacific Railway of the skeleton of a youth found in September, 1911, tightly wedged in a crevice about 50 feet from the centre line of the Canadian Northern Pacific Railway's construction at Kamloops Lake. This skeleton was secured by Mr. W. H. Melanson, the Resident Engineer of the Railway at Savona, and in compliance with orders issued by Mr. T. G. Holt, Attorney for the road at Vancouver, at the instance of Hon. William MacKenzie, was forwarded to Vancouver, from where it was sent as a gift of the Canadian Northern to the people of Canada. This single shipment, of course, is of minor importance compared with the *precedent which it established for the deposition in the national museum of all information and specimens obtained in railroad construction throughout Canada*. The Dominion Archæologist made request to several of the leading railroads of the country to instruct their engineers to carefully preserve all specimens found, and of *still more importance to send in information* regarding all antiquities and objects of handiwork as well as human remains *as a gift to the nation*. It seems only right that these objects of scientific value *should be preserved for the benefit of all the people rather than allowed to become scattered and destroyed* as is so often the case when they are uncovered by the activities connected with development and industries throughout the country. Accession 12.

An ancient human skull has also recently been received at the Victoria Memorial Museum as a gift from MacKenzie, Mann & Co., Limited. This was sent in by Mr. G. T. Holt, the Attorney for the road at Vancouver in compliance with orders issued by Hon. William MacKenzie to the authorities of the road to present

to the nation all scientific information and specimens discovered by the employees of the company. The particular skull was found by Mr. A. W. Phillips, Resident Engineer, at Tranquille. Unfortunately the bones found with it were buried in the dump by the ignorant labourers, but effort is being made by the authorities of the railroad to have them uncovered for the national museum. The skeleton was turned out near Tranquille by the grading machine plough about 8 feet below the surface of the ground and was sent to Mr. H. L. Johnston, Division Engineer at Savona. The Dominion Archæologist of the Canadian Geological Survey has urged upon the authorities and engineers of this road as well as upon those of the other great railroads of Canada, the Indian agents, and the North West Mounted Police, the great necessity of *saving whatever is found for the use of all the people of Canada*. Accession 13.

BOOK NOTICES.

ELEMENTARY ENTOMOLOGY.—By E. Dwight Sanderson and C. F. Jackson, pp. VIII, + 372, 496 figs. Boston: Ginn & Co.; \$1.50.

The need for a good introductory book on Entomology has been felt by teachers and those who are called upon from time to time to recommend such a book to one who may be desirous of taking up the science. Packard and Comstock have each given us excellent text-books for the student, but a book was desired of a more elementary character to put into the hands of the beginner, and one which would serve as an introduction to these and such other standard works as Sharp, Kellogg and Howard have written. Only those who have had experience in teaching entomology will realize the difficulties to be encountered in writing such a book. The authors of the present work have succeeded where others with less experience of teaching and often of the subject have failed. In so doing they have placed under a debt of gratitude not only teachers of entomology but the increasing number of those who are desirous of beginning a study of this subject. As the authors admit, the economic side has been made the dominant note in the book. For numerous reasons we think that this was a wise course to take; nor has the value of the book to the general student been diminished by unduly emphasizing the economic aspect.

The book is divided into three parts. The first part treats of the structure and growth of insects. In the second part the different orders are considered seratim in a most readable and interesting manner. The third part is extremely valuable as

it describes in very clear language the methods by which the elementary student may familiarize himself with and study the structure, life-history and classification of insects. An excellent key to the different orders is given; in the preparation of this key the authors have been fortunate in securing the helpful criticism of the leading authorities in the various orders, thereby rendering it increasingly valuable and accurate.

In a book of this nature there are naturally a number of points which, if space did not forbid, we might discuss. It is unfortunate that "oesophagus" should be mis-spelt throughout the book, and surely "axe" does not, even on the ground of simplified spelling, deserve to have the "e" chopped off (p. 337). The so-called "rasp-like" character and "rasping" function of the labial lobes of the house-fly and blow-fly (p. 18) are mistakes which have crept into entomological literature due to an incorrect interpretation of the nature of the pseudotracheæ resulting from lack of actual observation and careful examination. The statement that "no true gills, that is, gills carrying blood vessels, like those of fishes, are found in insects," whilst strictly true, might be misleading in view of the possession by larval Chironomids of respiratory filaments containing blood spaces and similar in function to the gill filaments of fishes. Among the minor mistakes we notice "*Corisidae*" (p. 108), "Torie" (p. 305) and the laying of Fig. 434 on its side. We are of the opinion that some mention of such important facts as parthenogenesis and the alternation of generations, etc., would have enhanced the biological side of the book.

The book is well illustrated with nearly five hundred figures which have been selected with considerable care from good sources, and we note with no regrets the absence of many old acquaintances which have been rightly allowed to enjoy their well-earned rest. To all, whether they be teachers or students or those merely desiring to learn something about insects, we recommend this book most heartily.

C. GORDON HEWITT.

THE FLIGHT OF BIRDS.—By F. W. Headley, M.B.O.U. With sixteen plates and many text-figures. Witherby & Co. 326 High Holborn, London; 163 pp. Price, 5s. net.

"The Flight of Birds" is the first book which has come to our notice dealing exclusively with the science of flight from an ornithological viewpoint. It is only within recent years that the subject has had much attention from naturalists, and this chiefly by European ornithologists. The subject seems not to have been studied to any extent in a systematic way on our own continent.

British naturalists, however, seem to have paid more attention to the study. W. P. Pycraft devotes a chapter to the subject in "The Story of Bird Life," and most of the prominent natural histories deal briefly with the machinery of flight. Mr. Headley seems to have given the subject careful study, and a large part of an earlier volume by him entitled "Structure and Life of Birds" was devoted to birds' flight. In the present volume the author has his subject well in hand and gives each phase a careful consideration. His theories in regard to the explanation of many phenomena in flight and of flight principles are logical and much observation has been supplied in their support.

A list of chapter headings will indicate the scope of the material dealt with. They are as follows: Chap. I, Gliding; II, Stability; III, Motive Power; IV, Starting; V, Steering; VI, Stopping and Alighting; VII, The Machinery of Flight; VIII, Varieties of Wing and of Flight; IX, Pace and Last; X, Wing and Flight, and XI, Some Accessories. Under each of these headings are many sub-headings and each phenomenon is discussed at some length and a plausible theory advanced in explanation.

There are sixteen plates, fourteen of which are from photographs, and twenty-seven other illustrations.

This book, because of the principles of flight set forth within its pages, should prove interesting to aviators as well as to ornithologists and we trust that it will receive the welcome at the hands of the public which it deserves.

E. W. CALVERT.

CAMROSE, ALBERTA, BIRD NOTES.

On the 13th of September, 1911, a Red-breasted Nuthatch spent over an hour in and around our yard in Camrose. This bird seems to be very rare in the prairie country, as this is only the second one I have seen in twenty years.

The Blue Jay seems to be more plentiful now than formerly. Previous to the last year or two, the only ones I noticed were on the river bottoms in the thick spruce. Twice in September last year I saw two different pairs in the willows on the level prairie many miles from any evergreens.

October 14th, 1911, saw a pair of Magpies about ten miles north of Lacombe. This is the furthest north I have observed this bird. They are not common by any means. I remember seeing one a number of years ago in mid-winter, east of Red Deer.

F. L. FARLEY.

THE OTTAWA NATURALIST

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NOVEMBER, 1912

No. 8

ADDITIONAL NOTES ON THE BIRDS OF NEWFOUNDLAND.

BY W. J. BROWN, WESTMOUNT, QUE.

In June, 1911, we experienced a stormy passage over night from North Sydney to Port aux Basques, Newfoundland, a heavy gale and sea tossing the Reid-Newfoundland Steamer "Invermore" around in such a manner as to make sleep impossible. In May, 1912, we had a most delightful trip, covering the distance of 102 miles in about six or seven hours. The Reid-Newfoundland Company have now a daily service between North Sydney and Port aux Basques. The new "Bruce" and "Invermore," although practically ocean liners in miniature, are trim, snug and comfortable, and afford excellent accommodation in every respect. At seven o'clock in the morning we were "locked up" in mist and fog, but the rasping foghorn, a mile away, gave indications of close proximity to the barren ranges of Newfoundland. Even a keen and enthusiastic ornithologist cannot look at Port aux Basques for the first time and smile, especially if it is raining and a heavy fog prevails. The "Port" presents one of the dreariest and most forlorn of pictures as a gate of entry into probably the finest paradise for birds and game in America. First impressions, however, are soon forgotten, as the scene ashore is one of great activity and the express train is waiting nearby to carry man and baggage into a magnificent camping ground among the mountains and waterways in the interior. The traveller soon finds himself passing along the banks of beautiful streams and is tempted to jump off to visit a pool, wherein, no doubt, lurk many large trout. But, this is no fishing excursion and the many songs and notes of the northern breeding sparrows and warblers soon divert attention. The train makes considerable noise en route, especially when going around curves, but above all this a continuous bird chorus can be heard outside the car windows.

There are some charming towns and villages along the Bay of Islands and here we noted many different species of birds nesting en masse in stunted spruce woods. A small area of

evergreen fenced in is called a "garden" by the Newfoundlander, and in such localities Fox and White-throated Sparrows, Ruby-crowned Kinglets, Robins, Black-poll and Magnolia Warblers, Purple Finches, Thrushes and Alder Flycatchers were nesting commonly. A few hundred yards beyond, Pine Grosebeaks, Water Thrushes, Winter Wrens, Redpolls, Black-throated-green Warblers and Chickadees were breeding and several pairs of Wilson's Snipe had their nests in bogs not more than 200 yards away from dwellings. Generally speaking, birds raise their young where food is most abundant, and this, no doubt, accounts, to a great extent, for the confluence of different species within the zone of civilization during the breeding season. Further inland, the country is less settled and bird life is not so congested. Up on the "barrens" one is forcibly struck by the comparative absence of birds, Gulls, Yellowlegs, and Least Sandpipers being in the majority.

The following is a list of the birds observed:—

LOON. On May 28th, a female specimen was shot by a section-man. The oviduct contained two eggs. The bird is common.

BLACK GUILLEMOT. Saw several flying a hundred yards off shore at St. George's Bay.

GLAUCOUS GULL. A few miles inland from St. George's Bay six or seven pairs of these birds were breeding on small islands in a lake. On June 3rd, the nests, which were placed on large boulders near the water, contained two or three badly incubated eggs.

GREAT BLACK-BACKED GULL. One pair had their nest in the same locality as the small colony of Glaucous Gulls referred to above. On June 3rd, the three eggs were ready to hatch.

HERRING GULL. Common. Their breeding grounds were not visited, but large numbers were observed feeding in St. George's Bay.

COMMON TERN. Hundreds noted in St. George's Bay the first week in June.

BLACK DUCK. On June 3rd, a nest containing ten incubated eggs was found on a small island in a lake a few miles inland from the sea.

BITTERN. Eight specimens were noted. Probably fairly common.

WILSON'S SNIPE. Abundant. A pair, or more, were found nesting in all the bogs we visited. Many nests with eggs were found the early part of June. The nests were merely depressions in moss lined with a few feathers and tops of grasses. While searching for nests of this species I came

upon an incubating female, the brown colour of the bird being easily distinguishable from the green moss upon which she was sitting. The bird allowed me to stroke her back without being the least disturbed and had to be lifted off the nest in order that a snapshot could be taken of the eggs. She at once turned a couple of somersaults and feigned a broken wing and remained in the immediate vicinity.

LEAST SANDPIPER. On June 18th, two nests were located near water, the eggs in each set numbering four. These were simply laid on grassy mounds in a large bog.

YELLOWLEGS. Common on the "barrens" and nesting in fair numbers.

SPOTTED SANDPIPER. Many nests located on the beach near Bay of Islands. A common summer resident.

PIGEON HAWK. Breeding in suitable localities and apparently the common hawk of the Island. The writer located a nest of this species on the ground in spruce woods on June 6th. The set of five eggs was laid underneath a stump, strips of bark and a few feathers forming the lining. A week later another nest was discovered some twenty feet up in a pine tree.

OSPREY. Two miles from St. George's Bay two nests were found. These were placed on the top of evergreen trees on the side of a mountain and within a few yards of a lake. On June 3rd, one nest contained three eggs far advanced in incubation and the other had two fresh eggs. June 10th, another nest was located in a big pine tree, it contained three newly hatched young.

BELTED KINGFISHER. Common.

NORTHERN FLICKER. One of the commonest Woodpeckers on the Island.

ALDER FLYCATCHER. Abundant. On June 28th, a nest with three fresh eggs was found in a low shrub.

LABRADOR JAY. Many birds seen in all localities we visited.

CROW. Only a few seen along the Humber River.

RUSTY BLACKBIRD. Saw a great many in spruce swamps during the first week in June, but no nests were found.

PINE GROSBEAK. This species is apparently a common breeder. It was noted at several points, especially along the Humber. By June 10th, the young had left one nest and two others were ready for eggs. On June 14th, one of the latter contained three fresh eggs. The nests were all placed at various heights in spruce trees and were built externally of twigs and lined with some kinds of bleached grasses, the whole being very shallow and frail.

PURPLE FINCH. Heard singing from the tops of evergreens in different places.

REDPOLL. Saw several flocks roaming about the country near Bay of Islands.

SAVANNA SPARROW. A common summer resident. On June 19th, a nest with eggs was found in the ground.

WHITE-THROATED SPARROW. One of the characteristic birds of the region and nesting commonly.

CHIPPING SPARROW. Common.

LINCOLN'S SPARROW. A common summer resident. The bird seems to prefer swampy localities where low growth is abundant. On June 8th, a nest containing four badly incubated eggs was found in the ground in a large tamarack bog. The nest, which was composed of dead grasses, was well concealed amongst withered weeds and rank growth. The bird is elusive and shy and also difficult to approach. It was only after an hour's watching that we were able to get a glimpse of her on the nest.

SONG SPARROW. Rare. A nest with four eggs was found on June 3rd in the ground. One individual was heard singing lustily from the top of an alder bush on the same date.

SWAMP SPARROW. Common summer resident. Six or seven birds were heard singing in chorus in a large swamp on June 3rd. A nest was found on June 5th, which contained three fresh eggs.

FOX SPARROW. Abundant. This is one of the earliest breeders in Newfoundland. On May 14th, when the snow was lying deep in the spruce woods, two nests were located, each containing three fresh eggs. On May 16th, 19th, 22nd and 24th, nests were found with full sets. All of these were placed from four to eight feet up in spruce trees. The birds frequently build much higher up. On June 10th, I located a nest, which had three large young, about twenty feet up in an evergreen. Various nesting sites are chosen. On June 8th, a nest of five young was found three feet up from the ground and placed between the trunk and loose bark of a large pine tree. Others were situated in the roots of upturned stumps. This year no nests were found on the ground. The nests were all built of twigs, moss, rootlets, etc., with a lining of plant stems, grasses and hair. Many young birds were observed skulking in the underbrush during the first week in June. The Fox Sparrow is a wonderful scratcher and quite frequently the birds were seen working industriously in scrubby potato patches.

WHITE-BELLIED SWALLOW. A large wave appeared at Stephenville on June 3rd. The next day they disappeared altogether.

BLACK AND WHITE WARBLER. A few specimens seen in damp evergreen woods.

YELLOW WARBLER. Fairly common. A few nests were located the latter half of June.

MYRTLE WARBLER. Only two birds noted.

MAGNOLIA WARBLER. On June 8th, a nest was located two feet up in a small spruce. The bird had not started to lay. Fairly common.

BLACK-POLL WARBLER. This bird's weak song was heard all along the Humber River in June.

BLACK-THROATED-GREEN WARBLER. One nest found on June 13th contained four fresh eggs. It was placed eight feet up in a pine tree.

OVEN-BIRD. Heard singing in many localities in mixed woods.

WATER THRUSH. Abundant. A nest was found under a bank along the Humber River. On June 12th it contained four fresh eggs.

MARYLAND YELLOW-THROAT. Common.

CANADIAN WARBLER. A moderate summer resident.

AMERICAN REDSTART. Saw several males near Bay of Islands.

AMERICAN PIPIT. On June 19th, a nest with three fresh eggs was found on the side of a moss-covered rock. The nest was built of dead grasses only.

WINTER WREN. Heard everywhere in spruce woods.

RED-BREASTED NUTHATCH. Common.

RUBY-CROWNED KINGLET. Abundant. During the second week in June several nests were found in small spruce trees, eight or nine eggs being the complement in each case.

VEERY. A few individuals noted.

OLIVE-BACKED THRUSH. Very common. Many nests found middle of June on stumps and in spruce trees, three and four eggs forming the set.

HERMIT THRUSH. Heard everywhere during the daytime and night.

ROBIN. Common.

DEPLETION OF BIRD LIFE IN NEWFOUNDLAND.

While the water-fowl are being needlessly slaughtered and exterminated on the sea coast, the birds in the interior are meeting with the same fate. Near two section-houses up on the "barrens" Ptarmigan feathers and skins were scattered about along the railway for some 200 yards. A few casual remarks elicited the fact that one party had shot over 100

"Partridges" during April and May. A glance up the road-bed certainly did not contradict this assertion. The flesh of the loon, as a rule, is not palatable, and why this species should also be glaringly shot when opportunity offers is questionable. A great number of Gulls have deserted their breeding grounds on the coast and are now endeavouring to raise their young in secluded localities inland. Year by year, however, the indiscriminate destruction of birds still goes on, and if drastic steps are not soon taken in the direction of protecting them, certain species will be wiped out altogether. Every lake has its quota of rafts, which are used in the springtime for robbing the Gulls.

LIST OF TRILOBITES FOUND AT OTTAWA AND IMMEDIATE VICINITY.

REVISED TO DATE BY J. E. NARRAWAY.

- Eoharpes dentoni* Billings, Trenton, very rare, E.
 " *ottawaensis* Billings, Trenton, very rare, E.
Triarthrus spinosus Billings, Utica, abundant, A.
 " *becki* Green, Utica, common, A.
 " *glaber* Billings, Utica, rare, E.
Bathyurus acutus Raymond, Pamela, rather common, F.
 " *superbus* Raymond, Pamela, rather common, B.
 " *extans* (Hall), Lowville, common, C.
 " *spiniger* (Hall), Lowville and Black River, common,
 rarely in Black River, D.
 " *ingalli* Raymond, Trenton, rare, D.
Cyphaspis trentonensis Weller, Black River, very rare, D.
Basiliscus barrandi (Hall), Black River, rare, E.
Ogygites canadensis (Chapman), Utica, abundant, B.
Onchometopus simplex Raymond and Narraway, Pamela, rather
 common, C.
Isotelus arenicola Raymond, Chazy, rare, C.
 " *gigas* Dekay, Lowville to Trenton, rather common, B.
 " *latus* Raymond, Trenton, common, B.
 " *maximus* Locke, Lorraine, rather common, C.
 " *iowensis* Owen, Lowville and Black River, rare, C.
Isoteloides homalnotoides (Walcott), Black River, rare, D.
Iliaenus angusticollis Billings, Black River, rather common, C.
 " *conradi* Billings, Black River, common, B.
 " *latiaxiatus* Raymond and Narraway, Black River,
 rather rare, E.
 " *americanus* Billings, Trenton, rare, B.

Bumastus milleri (Billings), Lowville and Black River, rather common, A.

" *indeterminatus* (Walcott), Black River, rather rare, E.

" *billingsi* Raymond and Narraway, Trenton, rather rare, C.

Thaleops ovata Conrad, Black River, common, C.

Calymene senaria Conrad, Trenton, abundant, A.

Cybele ella Narraway and Raymond, Black River, very rare, C.

Ceraurus pleurexanthemus Green, Black River to Utica, common, B.

" *dentatus* Barton and Raymond, Trenton, rare, D.

" *bispinosus* Barton and Raymond, Black River, very rare, E.

Dalmanites achates Billings, Trenton, rather common, C.

" *bebryx* Billings, Trenton, rather rare, C.

Pterygometopus callicephalus (Hall), Black River and Trenton, common, C.

Amphilichas trentonensis (Conrad), Trenton, very rare, F.

" *cucullus* (Meek and Worthen), Trenton, very rare, E.

Arges wesenbergensis paulianus Clarke, Trenton, rather rare, E.

Encrinurus vigilans Hall, Trenton, very rare, C.

Bronteus lunatus Billings, Trenton, rather rare, B.

Odontopleura trentonensis (Hall), Trenton, rather rare, C.

Proetus parviusculus Hall, Trenton, rather rare, D.

A. Entire specimens common.

B. " " sometimes, but usually fragmentary.

C. " " very rarely, but usually fragmentary.

D. No " " always fragmentary.

E. " " generally cephalo or cranidia.

F. " " " pygidia.

SUMMARY.

In all 43 specimens of 22 genera distributed as follows:

In Chazy formation	1 species	1 genus
" Pamela formation	3 "	2 genera
" Lowville formation	5 "	4 "
" Black River formation	16 "	10 "
" Trenton formation	19 "	15 "
" Utica formation	5 "	3 "
" Lorraine formation	1 "	1 genus

Entire shields have been found of 26 species; 17 species are still known only from fragments.

The compiler has endeavoured to eliminate all doubtfully or incorrectly identified species, and to bring the nomenclature up to date, thus establishing a list which may be relied on as a

basis, but which it is hoped will be added to by future collectors. It is morally certain that several other species occur in the district, as fragments have been found which undoubtedly belong to species not here enumerated, but which do not afford sufficient data for positive identification. For example, fragments have been collected of the genera *Remopleurides*, *Cybele*, *Dalmanites*, *Pterygometopus* and *Iliaenus* which cannot at present be definitely referred to any of our previously known species.

HARRIS' SPARROW IN ONTARIO.

BY W. E. SAUNDERS, LONDON, ONT.

This sparrow is absolutely unknown to almost all Ontarians, unless they have met it in the west. Because it belongs to the genus *Zonotrichia* one is inclined to feel that it should have white around the head, but it reverses this common character of the white-throat and the white-crown, and has, in full plumage, a large black patch on the throat, and some black on the top of the head. The remainder of the colouring is of the same general type as that of the eastern birds, but it is larger, measuring seven inches in length.

The only published record of this bird for Ontario occurs on page 7 of the "Mammals of Ontario," by Dr. Gerritt Miller, where he casually mentions the presence of *Zonotrichia querula* at Nepigon in September, 1896.

Another record south of Ontario is the mention of a specimen taken, and four or five others seen, near Columbus, Ohio, on April 28th, 1889, which occurs in the 5th edition of Davies' "Nests and Eggs," page 377.

In the west, we find it occurring more frequently, and Prof. Barrows writes me that the first Michigan specimen was taken at Palmer, Marquette Co., on Sept. 30th, 1894; the second at Battle Creek, Oct. 12th, 1894; the third at Sault Ste. Marie, Mich., on Feb. 22nd, 1900.

At London, I have met this bird but once, and the occurrence stands as the only positive occurrence in eastern Ontario. On March 18th, 1907, while walking in from the country about 8 a.m., I heard what seemed to be a single long-drawn note of the white-throated sparrow, high pitched as usual, and as the date was very early for this bird, I stopped to investigate. Among a company of juncos and song sparrows, in a garden, was one large dull-coloured sparrow which I suspected of being the author of the note, and which I took at once to be a Harris. A request to the lady of the house brought forth a point blank

refusal to allow me to shoot anything, as there was "nothing but robins here." Promising not to shoot, I went out to look, and by "looking" at sufficiently close range, and from the right direction, I scared the bird across the road; and having profited by experience, I proceeded to shoot it first, and ask permission afterwards. It proved to be a male in immature plumage, spotted irregularly on the upper breast, the spots giving a hint of the black colouration which was to come. The specimen is now number 1797 in my collection.

This short fragment of a song brought back to my memory a peculiar song, consisting of a single whistled note pitched at the usual range of the white-throat, which I heard as my train stopped at a station near Wabigoon, north-west of Lake Superior, on June 30th, 1906. I had ascribed this song to the white-throat, but, from its resemblance to the call of the captured Harris, I feel sure that there is a chance of its author being of the latter species.

One would infer from Dr. Miller's reference that the Harris was not uncommon at Nepigon, and if it turns out that it breeds regularly north of Lake Superior, a southward migration through lower Ontario should be noted with moderate frequency.

Two of the dates quoted above are rather interesting, Feb. 22nd, 1900, at the Sault, and March 18th, 1907, at London. Both of them are much in advance of the white-throats' migration, and yet it appears that the date of the migration of Harris' sparrow in the west is rather late, apparently between that of the white-throat and the white-crown.

It should also be mentioned that Mr. I. Hughes Samuel saw a bird which he took to be a male of this species near Toronto during the spring migration, about the year 1898, but as no record had ever been published of the capture of this bird in Lower Ontario, the occurrence was never published.

Apparently this bird should be looked for in early flocks of sparrows in February and March, and at that time all attempts at a song resembling that of a white-throat should be carefully investigated.

THE CANADIAN RUFFED GROUSE.

The Canadian Ruffed Grouse (*Bonasa umbellus togata*), popularly known as the "partridge," is one of our most widely-distributed game birds, being found wherever there are woods, from New Brunswick to British Columbia, and as far north as Hudson's Bay. It is a handsome grayish bird of markedly

gallinaceous appearance, some seventeen inches long and of stout build. The extraordinary "drumming" noise made by the male bird to call the female is familiar to everyone who frequents the woods in the spring. To produce this remarkable sound the bird stands on some slight elevation, such as a log or a stone, and strikes the air strongly with his outstretched wings. The first four or five strokes, occurring at intervals of about half a second, sound like blows on a rather dull bass drum, but they rapidly get faster and faster until the sound becomes continuous like the roll of a snare drum. The whole performance lasts, perhaps, ten seconds, and is repeated every few minutes for some time.

In the northern part of its range this bird has another peculiar habit, that of tunnelling into a snowdrift for protection against the intense cold. In order to begin its tunnel it sometimes walks around, deliberately burrowing here and there into the snow with its head until it finds a suitable place, but its general procedure is to dive from an elevated branch or directly off the wing into the drift, the momentum of its plunge being sufficient to drive it some little way into the soft snow, and thus enable it to start its tunnels conveniently. Then, at a depth of three or four inches under the surface, it scratches out a horizontal or slightly descending passage about two feet long, the end of which it enlarges into a roughly spherical chamber eight or ten inches in diameter, the removed snow completely blocking up the entrance tunnel. Here the bird, apparently preferring hunger to cold, may spend several days if the weather is severe. Except for one mark where the tunnel begins, the surface of the snow is quite undisturbed, and no one would ever suspect that a live warm bird was concealed in the drift. To leave its burrow, the bird simply bursts out through the overlying layer of snow, springing into immediate flight.

One day last January, when the thermometer stood 10° below zero F., I stopped a moment while snowshoeing through the woods to examine a curious isolated mark on the snow. At that instant a "partridge" burst out just at the toes of my snowshoes, and with a great whirr of wings disappeared among the spruces. The mark I had noticed was the entrance to the tunnel, and from its appearance the bird had evidently been three or four days in its burrow, and would doubtless have remained there longer if my approach had not frightened it out. Dry, soft snow is, of course, an excellent non-conductor of heat, and even in the very coldest weather, the ruffed grouse is no doubt quite comfortable in its immaculate chamber.—CHARLES MACNAMARA, in *Knowledge*, Aug., 1912.

OBITUARY.

JOHN CRAIG, M. S. Agr., Late Professor of Horticulture,
Agricultural College, Cornell University, Ithaca, N.Y.

The recent death of Prof. John Craig is deeply deplored by his many friends. Those who knew him when he lived in Ottawa will remember his tall, manly figure; his rugged strength and the iron-like grip of his hand, and they can scarcely believe that with his great physique serious illness could lay hold upon him. But, he has been cut down in the prime of life. He died at Siasconset, Massachusetts, on August 10th, 1912, at the age of 48 years, after an illness of several months.

When Mr. Craig came to Ottawa in 1890 he soon joined the Ottawa Field-Naturalists' Club, becoming a member that year, and until he left the city in the autumn of 1897 he took an active part in the Club's work. He was particularly interested in botany and was a leader in that branch. He contributed many interesting articles on botanical and horticultural subjects to THE OTTAWA NATURALIST, both while he was in Ottawa and after leaving here. He was Treasurer of the Club in 1897.

Mr. Craig was born at Lakefield, Argenteuil Co., P.Q., in 1864. His father, the late William Craig, was manager of the estate of the late Chas. Gibb, a noted horticulturist of Abbotsford, Quebec, a lover of fruits and flowers, from whom Mr. Craig received the inspiration which decided him to make horticulture his life's work. From the High School in Montreal he went to the Agricultural College at Ames, Iowa, in 1885, where he specialized in horticulture and economic botany, becoming, in 1887, Assistant to Prof. J. L. Budd, Professor of Horticulture, and, in 1888, Assistant to the Director, having charge, while he held the latter office, of the Department of Horticulture of the Iowa Agricultural Experiment Station. In January, 1890, he entered the service of the Dominion Government, becoming Horticulturist of the Central Experimental Farm, Ottawa, which position he held until the autumn of 1897. The work in horticulture developed greatly under him. The use of Bordeaux Mixture in preventing the development of certain diseases of fruit was practically unknown in Canada when he began experiments and as early as 1890 we find him trying different formulæ to determine the best to use. To his energy in rapidly spreading the good news of the possible control of apple scab, is largely due the wide and early use of Bordeaux Mixture in Canada. When the San José Scale was first discovered

in Ontario in 1896 the prompt action which was taken to control it was largely due to him. In 1893, he assisted the Provincial Government in organizing the Ontario Fruit Experiment Stations.

He was one of the most enthusiastic and energetic workers in the Ottawa Horticultural Society, while in Ottawa, and was one of the few who organized the Society in 1893. He was president of that Society for 1895, 1896 and 1897, during which time it developed rapidly.

Mr. Craig resigned his position as Horticulturist of the Central Experimental Farm in 1897 and went to the United States, where he took a special course at the Agricultural College at Cornell University, obtaining the degree of Master of the Science of Agriculture there in 1899. He was appointed Professor of Horticulture and Forestry of the Iowa State Agricultural College in 1899, which he held until 1900 when he accepted the position of Professor of Extension Teaching at Cornell. He filled this office until 1903, when he became Professor of Horticulture of the Cornell Agricultural College, which post he held until his death.

Prof. Craig filled many offices in the United States and served on many important committees. He became Secretary of the American Pomological Society in 1903 and was still Secretary when he died. Notwithstanding his many other duties he edited *The National Nurseryman*, a trade paper of importance, and the organ of the American Association of Nurserymen. Prof. Craig's outstanding qualities were his strength of will, by which he overcame many obstacles, and his capacity for work, which, with his determination to succeed, led him from one important position to another.

His courtesy to those who worked with or under him was very noticeable and much appreciated. He had a keen sense of humour which in time, of difficulty, and even of sickness, did not leave him. He loved horticulture in all its branches and being intimately connected with it from his early youth he had a broad insight into, and a great knowledge of, the whole field.

He was loyal to his friends who, though scattered far throughout Canada and the United States, felt during his life that he was always true to them.

W. T. MACOUN.

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ON THE NATURE OF THE SO-CALLED "COVERING PLATES" IN PROTOPALÆASTER NARRAWAYI.

BY PERCY E. RAYMOND.

In the autumn of 1910, Mr. J. E. Narraway, of Ottawa, found a small starfish in the Black River limestone at City View, a short distance west of the Central Experimental Farm at Ottawa. On examining the specimen on his return from the field he found that the central groove in two of the rays was roofed over, for a short distance, by flat, alternating plates which met on the median line and formed a tight, tent-like covering over the groove. Furthermore, these plates were borne by two rows of small plates just inside the marginal series, and each plate was provided with a cup-like pit into which the proximal end of a covering plate fitted. The specimen had every appearance of being exposed from the actinal side, and assuming that such was the case, the plates were interpreted as being homologous with the covering pieces over the ambulacral grooves of cystids and crinoids. Mr. Narraway at once drew the writer's attention to the specimen, and I fully agreed with him as to its nature and importance. It was next shown to Professor Hudson, whose work on Ordovician echinoderms is well known. He concurred in our views of the specimen, which he studied with great care, and he finally described and figured the species in *THE OTTAWA NATURALIST* for May and July, 1912. Before the publication of his paper, photographs and descriptions had been seen by three or four paleontologists and students of recent echinoderms, and, it must be confessed, all dissented from our view as to the nature of the "covering pieces."

Recently, in searching the collection of starfish in the Museum of Comparative Zoology, Cambridge, Mass., the writer came upon what seemed to be a second specimen showing the "covering plates." (See plate VI, fig. 1). This specimen has three imperfect arms, all of which show the groove covered by alternating plates which are obtusely pointed at their distal ends, where they fit together closely. Some of the plates have been removed from portions of the arms, and it is then seen that the

"covering plates" are supported by small plates with a pit on top, just as in *Protopalæaster narrawayi*. Outside the row of plates bearing the "covering pieces" is a row of small spine-bearing marginals, so that, though the plates are of very different size, there is a complete analogy in arm structure between this specimen and the one found by Mr. Narraway. If the specimen had shown no more than this, it would have been a valuable support to our interpretation of Mr. Narraway's specimen, but on examining it more closely, small patches of top-shaped plates were discovered. These patches are so arranged as to suggest that they once formed part of a covering over the structures now exposed on the arm. On comparing these plates with those on the abactinal side of *Urasterella pulchella*, (Billings), it was found that they were identical with them. Furthermore, the arms of the specimen are of the same shape as those of the *Urasterella*, and that species has small, spine-bearing marginals. The specimen figured is from the Walcott-Rust quarry at Trenton Falls, N.Y., and is associated with specimens of *Urasterella pulchella*.

This specimen shows that, in this case at least, the covering pieces are really ambulacral ossicles, exposed by the removal of most of the abactinal skeleton. Dr. H. L. Clark, to whom I am indebted for many helpful suggestions in regard to this matter, remarks that such a condition of preservation might be expected to be very common, as the actinal side of a starfish, being buried in the mud, might easily be preserved, even though the abactinal side, not so protected, disintegrated.

The chief reason that Narraway, Hudson and myself had for thinking that *Protopalæaster narrawayi* was exposed from the actinal side was that the covering pieces did not look like ambulacral plates, and that they made an apparently tight and imperforate roof over the groove. These plates, instead of being narrow and grooved at the sides for the protrusion of the tube-feet, were wide, thin, and fitted closely together at the sides and ends. But the same condition obtains in the specimen here illustrated, and our argument must fall. A fact in regard to Mr. Narraway's specimen to which we did not attach enough importance is the way in which the marginal plates are truncated on the side now exposed to view. The outer faces are rounded and granulated, and one would expect the lower (actinal) faces to be rounded also. The faces actually presented, however, are flat and smooth, as would be expected if they served as a foundation for the plates of the abactinal side.

The specimen of *Protopalæaster* also shows two plates resting on the disk for which a place can not be found in the structure of the specimen. (See figure 2 of the plate). Professor

Hudson interpreted the larger of these plates as an interradiial marginal from another specimen of this species, but the writer is unable to accept this interpretation for two reasons. The first is, that although the shape is much the same as that of one of the interradiial marginals, still there is an important difference. This plate is pointed at the wider end, and evidently had a plate resting against each of the two plane faces at that end. The interradiial marginals, on the other hand, are not pointed, but have a plate resting directly against the end on a line with the long axis. Secondly, the large plate has another fairly large plate still in position, resting against one of the faces on the larger end, and this plate is larger and of different shape from any of the plates which abut against the inner faces of the interradiial marginals. Moreover, if these were plates foreign to this specimen, they would not maintain their natural position in relation to each other, but would be separated. It seems probable that they are plates of the abactinal system of this same specimen, and that they are not far from their original position. A specimen of *Palæaster matutina*, Hall, in the Museum of Comparative Zoology, shows interradiial marginal plates of this same form on the abactinal side.

It thus seems probable, both from analogy with the specimen of *Urasterella pulchella* here figured, and from the structure of the specimen itself, that the "covering plates" of *Protopalæaster narrawayi*, are really ambulacral ossicles exposed from the upper side.

EXPLANATION OF PLATE VI.

1. *Urasterella pulchella*, (Billings). A specimen exposed from the abactinal side, with nearly all the plates of the abactinal skeleton weathered away, exposing the ambulacral plates. Near the ends of two of the arms some of the ambulacrals are lost, revealing the pits in the adambulacrals. On the arm running to the left, a small patch of plates of the abactinal covering are still to be seen in position, covering the ambulacrals. The spinose marginals show but faintly in this photograph. The figure is three times natural size, and the specimen, which is from the upper part of the Trenton at Trenton Falls, New York, is in the Museum of Comparative Zoology.

2. *Protopalæaster narrawayi*, Hudson. A photograph of the holotype, showing the "covering plates," and the large displaced plate which is now believed to be an interradiial marginal belonging to the abactinal size of this specimen. Note the pointed inner end of this large plate and the smaller plate still in position against one of its faces. This figure is 2.66 times natural size, and was made by Professor G. H. Hudson.

3. The same species. Side view of one of the arms, showing the tuberculate outer surface and the smooth and truncated upper surface of the marginal plates. This is 9.5 times natural size. Photograph by Professor Hudson.

4. The same species. View of the same arm, looking down from above, showing the pits in the adambulacrals, and the closely fitting "covering plates." This is 9.5 times natural size. Photograph by Professor Hudson.

NOTE ON A RIPPLE-MARKED LIMESTONE.*

BY E. M. KINDLE.

The occurrence of ripple-marks on sandstone is a common phenomenon to every geologist, and nearly every one has observed these beautiful flutings in process of formation on the sands of lake or sea shore. The literature on ripple-marks relates almost entirely to these familiar sand or sandstone ripples. The occurrence of ripple-marks on limestone seems to be a phenomenon of such relative infrequency that it appears desirable to record an example which has come under the writer's notice.

The ripple-marks which will be described characterize certain Devonian limestone strata in northern Manitoba. The basin of Lake Winnipegosis is excavated chiefly in limestone of Devonian age, and the principal outcrops of these beds in Manitoba occur around the shores and on the islands of this lake. The best exposures of the Devonian strata about the southern end of the lake, appear on Snake Island.

This island, as noted by Mr. J. B. Tyrrell¹, is classic ground in western geology, having furnished the collection of fossils made by Prof. H. Y. Hinde in 1858, which first determined the presence of Devonian rocks in Manitoba, but the ripple-marked limestone appears not to have been noted by previous observers.

I visited this locality during the past summer, and in company with Mr. A. MacLean examined the interesting ripple-marks which are best exposed on the surface of a large block of limestone which has broken down from the cliff near the northwest corner of the island. This cliff is shown in plate VII,

* Published with the permission of the Director of the Canadian Geological Survey.

¹ Tyrrell, J. B.—Report on Northwestern Manitoba with portion of adjacent districts of Assiniboia and Saskatchewan: Geol. Surv. of Can., Pt. E, Vol. V, 1889-90-91, (1892) p. 163 E.

figure 1. One of the large limestone blocks which has fallen from the face of the cliff, exhibits the large clearly moulded ripple-marks shown in figure 2. The crests of these are two feet apart, and rise about one and one-half inches above their troughs. The ripples curve slightly in crossing the surface of the limestone. The rock on which they are impressed, is a comparatively pure non-magnesian limestone. The surface of the ripple-marks show great numbers of finely comminuted shell fragments. These small fragments of various kinds of molluscan shells, comprise a large share of the material composing the limestone in the middle third of the cliff section in which the ripple-marks occur. These broken shell fragments thus strongly supplement the evidence of the large ripple-marks in indicating vigorous disturbance by wave action of the sea bottom in which they originated. Beyond this fact, it is perhaps not safe to make any deductions regarding the physical conditions under which these ripple-marks were produced. It is clear that the water was of sufficiently moderate depth to permit wave action to agitate the bottom, but it does not follow on the other hand, that the sea was extremely shallow. Nor is any valid ground afforded for the assumption of beach conditions which the discussion of ripple-marks presented in some texts² might lead one to make. It has been shown by Mr. A. R. Hunt³ and others that "ripple-marks occur at much greater depths than is commonly supposed." Dana⁴ has stated that "ripple-marks may be made by the vibration of -3- waves even at depths of 300 to 500 feet." The unusually large size of these ripple-marks suggest water of greater depth than that which develops the ripple-marks seen along many beaches. Hunt's observations have shown that thousands of specimens of marine shells are sometimes killed in six fathoms of water by wave action. The same observer has found evidence of much damage to shells living in fifteen fathoms from the same cause⁵. The broken shell material in these limestones might therefore have been produced in water a few fathoms in depth. The limestones which immediately follow the ripple-marked beds in the cliff section of Snake Island show but little fragmental material, the fossils contained in them being in a good state of preservation. Ripple-marks appear to be absent from these upper beds.

² LeCont states (*Elements of Geology* 1888, p. 3a), "By means of these characteristics (ripple marks) of shore deposit, many coast lines of previous geological epochs have been determined."

³ On the formation of ripple marks: *Proc. Roy. Soc. Lond.*, Vol. XXXIV, p. 8, 1883.

⁴ J. D. Dana, *Manual of Geology* 2d ed. p. 665.

⁵ *Op. cit.*, pp. 8, 12.

The ripple-marked beds of the Snake Island section lie not far above the *Stringocephalus* dolomite. Since the dolomite bearing *Stringocephalus burtoni* does not appear in the Snake Island section, the precise distance of the ripple-marks above this formation cannot be stated. They belong near the base of a formation called the Manitoban. The following fossils, determined by Prof. J. F. Whiteaves, are recorded from the limestones of this formation on Snake Island by Tyrrell.⁶—

Cyathophyllum vermiculare var. *precursor*,

Alveolites vallorum,

Atrypa reticularis,

A. aspera,

Cyrtina hamiltonensis,

Rhipidomella striatula,

Paracyclas elliptica,

Raphistoma tyrrelli,

Belerophon pelops,

Euomphalus subtrigonalis,

Omphalocirrus manitobensis,

Cyrtoceras occidentale,

Gyroceras submamillatum,

Dinichthys canadensis.

To this list may be added *Astraeospongia hamiltonensis*. The small six-rayed spicules of this sponge occur in large numbers in a band of limestone 8 inches below the top of the cliff shown in figure 2. On the evidence of this fauna these beds were assigned to an Upper Devonian horizon by Whiteaves.⁷

POPULAR ENTOMOLOGY.

THE ENGRAVER BEETLES (FAMILY IPIDÆ).

(Continued from Vol. XXV, page 145.)

By J. M. SWAINE, Assistant Entomologist for Forest Insects,
Division of Entomology, Ottawa.

The Ambrosia-beetles, or Timber-beetles, breed entirely within the wood, the eggs of some species being laid well within the heart-wood. They bore small, round tunnels directly through the bark and into the wood. There may be several secondary egg-tunnels cut by two or more females, branching from a primary entrance-tunnel. On the other hand the tunnels

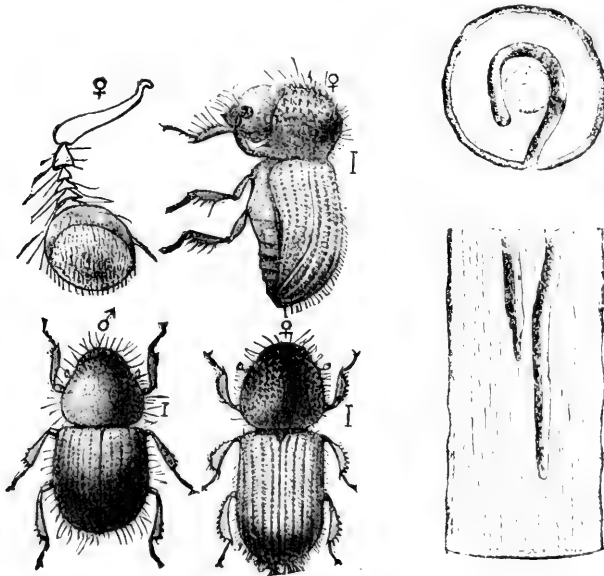
⁶ Geol. Surv. of Can., Pt. E, Vol. V, 1889-90-91 (1892), p. 163 E.

⁷ Contrib. Can. Pal., Vol. I, Pt. IV, p. 258, 1892.

of some species of *Anisandrus* consist merely of a short entrance-tunnel and one or two short lateral brood tunnels cut immediately beneath and parallel to the wood surface. Rarely, the tunnels of closely allied species may branch from a common entrance-tunnel.

The number of males in some genera of this group is small; in some species of *Anisandrus* there are seldom more than one or two males in a brood of from twelve to twenty. With some species the males are apterous, and the females are fertilized before leaving the brood trees.

In two genera, *Anisandrus* and *Xyleborus*, the eggs are deposited free in the tunnels and with most species the larvae feed solely upon the fungus without cutting any tunnels of their own whatever. The larvæ of *Platypus* live free in the tunnels until nearly ready to pupate, when short pupal cells (cradles) are cut from the sides of the tunnels deep within the wood.



THE SHOT-HOLE BORER, *Anisandrus dispar*. Adults, an antenna, and tunnels in an apple branch. (After Hubbard).

In *Corthylus*, *Trypodendron*, *Pterocyclon* and *Gnathotrichus* the eggs are laid in shallow niches cut by the female along the sides of the tunnel, and usually well within the wood; the larvæ extend these niches away from the tunnel, forming larval cradles, in which they remain until mature. The length of the completed cradles is slightly greater than that of the adult beetle.

The adults of the Ambrosia-beetles bestow a certain amount of care upon the young larvæ, furnishing them with the initial supply of food-fungus, referred to below, and removing the excrement from the tunnels outside the cradles.

The chief food of these beetles is a fungus known as Ambrosia, which they propagate within their tunnels. From this habit comes the name "Ambrosia-beetles." The tunnels are kept entirely free from chips and refuse, and the walls are covered by the fungus growth. So far as known, except in the cases of a few closely-allied forms, each species of beetle uses a characteristic species of fungus. The mycelium of the fungus pervades the tissue about the tunnels for one or two millimetres, colouring the wood dark brown or black, so that the tunnels have the appearance "of having been bored with a red-hot wire." By this means the tunnels of Ambrosia-beetles are easily distinguished from those of other wood borers. When new tunnels are cut, the fungus is carried there by the beetles, and started upon the tunnel walls, in some cases in specially-prepared tunnels upon beds of chips and excrement.

When working in large trees some species enlarge the same set of tunnels through several generations; but usually each generation excavates a new abode in dying parts of the same or other trees.

Very few of our timber-beetles enter healthy wood; almost invariably they select trees in which the sap is unhealthy, at least in the portion attacked. Their tunnels admit fungi to the deeper layers of wood, and ruin the timber for the most valuable uses.

THE TWIG-BEETLES.—The Twig-beetles include a few species belonging mainly to the genera *Hypothenemus*, *Pityophthorus* and *Micracis*. They bore into the bark and wood of terminal twigs of trees and shrubs both for food and for breeding purposes. They feed upon the bark and wood, and in some cases apparently upon buds and young shoots. Some engrave the wood surface as do the Bark-beetles; some have in addition deep chambers within the wood; and with others the primary tunnel is cut through the pith itself. With some species the eggs are laid free in the primary tunnels, and the larvæ either feed upon the tunnel walls or cut longer or shorter mines through the wood. Several species of this group have a very close relation to a fungus always found in their tunnels.

A summary of the borrowing habits of these first three groups brings out some interesting relations. Among the Bark-beetles the eggs are usually laid in niches along the sides of the primary tunnels, and the larval mines are usually well-developed. A few species cut their tunnels and mines entirely in the bark;

many cut them between the bark and the wood, the pupal-chambers being merely an enlargement of the ends of the larval-mines; others form the pupal-chamber by driving the ends of the larval-mines a half inch or less vertically into the wood, some even cutting the distal half of the larval-mines just below the wood surface; and lastly, a very few small species cut almost the entire system of tunnels and mines slightly below and parallel to the surface of the wood. The Twig-beetles cut both tunnels and mines, when the latter are present, through the wood and pith of twigs. Among the Ambrosia-beetles the tunnels are in all species entirely within the wood, but the depth to which they enter varies considerably with the species. In the genera *Corthylus*, *Pterocyclon*, *Trypodendron* and *Gnathotricus* the eggs are laid in niches along the sides of the tunnels, and the larvæ cut very short mines, known as cradles. The species of *Platypus* lay the eggs free in the tunnels, but the larvæ when nearly ready to pupate cut short cradles in which they pupate and remain until mature. In the genus *Xyleborus* the eggs are laid free within the tunnels, but the larvæ cut no cradles, pupating in the primary tunnels. There is thus a fairly well-marked gradation in habit, both as to the depth of the tunnels and mines below the surface and as to the degree of development of the larval mines.

The fourth group contains those species not included among the Bark-beetles, Ambrosia-beetles and Twig-beetles. The American species are few in number. *Coccotrypes dactyliperda*, an imported form, burrows in date seeds; *Cryphalus jalappæ* is found in jalap root; *Hypothenemus cruditus* burrows in nuts, book-bindings, and other dry substances, as well as in dead twigs of grape and orange; *Pityophthorus coniperda* occurs in pine cones; *Hylastinus obscurus* bores in the roots of clover; and *Cactopinus hubbardi* in the pith of the giant cactus.

Enemies of the Scolytidæ.—The Scolytids have many natural enemies. They are preyed upon by many predaceous and parasitic insects, by birds, and are frequently attacked by fungous diseases.

Adults and larvæ belonging to the families Cleridæ, Staphylinidæ, Colydiidæ, Histeridæ and others enter the burrows and feed upon the eggs, larvæ, pupæ and adults of the Scolytids. The predaceous larvæ often burrow through the larval-mines after the Scolytid larvæ, which they finally overtake and devour. Various dipterous larvæ feed upon the eggs and younger stages. Many small hymenopterous parasites prey upon the larvæ and pupæ, and have even been bred from the adults. Larvæ of large wood-boring beetles, such as *Monohammus*, destroy the Scolytid tunnels by their borings and prove serious enemies to the beetles.

Woodpeckers destroy large numbers of the Bark-beetles, and at times help considerably to check their ravages.

The tunnels, especially of the Timber-beetles, are frequently overrun with various species of mites. The eggs of these mites hatch before the young beetles are ready for their flight, and in this way young and adult mites are carried by the beetles attached to their bodies to the new tunnels. At certain times the declivity of the elytra of various species of *Ips* (*Tomicus*) will be found covered with minute mites, and *Pterocyclon mali* and *P. fasciatum* are frequently almost completely covered with them upon emerging from their tunnels in the spring. Many of these mites appear not to injure their hosts; but certain species are very destructive, and breed in the larval galleries or pupal cells upon the young of their hosts.

Fungous diseases are sometimes very destructive to them. All stages of the insects are frequently found, more particularly in wet weather, filled and covered with the white mycelium of the fungus. In a felled pine log I noticed that hundreds of adult *Ips pini* had died from this cause in less than two weeks.

Friends of the Scolytidæ.—As these beetles feed mainly upon dying and dead branches and trunks of trees, any cause which tends to weaken or destroy the trees aids the Scolytids in supplying the proper food-plant. Heavy storms, forest fires, other insects, and the destructive work of man, are perhaps the chief of these.

Economic Importance.—Owing to the destructive habits of many of its members, the family Scolytidæ is of considerable economic importance. The injury done by these beetles may take two forms: living trees may be weakened and killed, and standing and felled timber and sawn lumber may be rendered useless for many purposes by the tunnels of the beetles.

But few Scolytids attack living, healthy trees, although there are a few species which apparently choose only trees in this condition. The majority of species attack only dying or dead trees, and a few breed in dead wood only. Stumps, diseased or dead branches, brush piles and recently-felled logs are their favourite breeding places. Most species will not, as a rule, molest living trees at all if rapidly-dying and recently-felled food-plants are available, but if trees in this condition are not to be had in sufficient quantity, many of these species will attack perfectly healthy trees and prove very destructive.

The injury done by the species which attack healthy and diseased trees is, in certain regions and at recurring intervals, very considerable. The work of *Dendroctonus frontalis* in the spruce and pine of West Virginia and the adjoining States, of *D. piceaperda* in the spruce of the Northeast, and of *D. ponderosa*

in the spruce and pine of the Black Hills of South Dakota, may be cited in illustration. *D. frontalis* and *D. ponderosa* attack the living, healthy spruce and pine, and in spite of the resin are able successfully to rear their young within the bark. The tunnels and mines thus formed interfere seriously with the flow of sap, and either kill the tree outright or induce an unhealthy condition favourable to the assistance of other borers and fungous diseases. It seems very probable that many destructive forest fires have been fed by trees dying or dead from the attacks of Scolytids. At present *D. murrayanae* is destroying Jack Pine in Manitoba; and several species of *Dendroctonus* are destructive to pine and spruce in British Columbia. *D. valens* is causing more or less injury at present in pine and spruce in Ontario and Quebec forests.

The Timber-beetles, by driving their tunnels through the wood in many directions, often render timber unfit for use.

Hylastinus obscurus breeds in the roots of clover in many parts of the Northeastern States and in Canada, and in some localities proves a serious pest.

Corthylus punctatissimus occasionally does considerable damage in young sugar-maple plantations.

Scolytus rugulosus, the fruit bark-beetle, attacks unhealthy fruit trees, and occasionally bores in those apparently sound.

Phlæotribus liminaris frequently attacks peach and cherry.

Xyleborus dispar sometimes occurs in diseased or weakened apple trees.

BIRD NOTES, 1912.

During February and early March three species of ducks were seen in London, Ont., at the forks of the Thames, just opposite Dundas Street bridge. Over this bridge the street cars, waggons and foot passengers were constantly passing. The ducks were apparently attracted to the spot by a stretch of open water, the severe frosts of last winter having rendered such feeding grounds unusually scarce.

Feb. 4th—A. Merganser about 20, Golden Eye about 10.
Feb. 15th—A. Merganser 43, Golden Eye 15, Old Squaw 2 (1 m. 1 f.). They were seen at intervals till well into March.

A new record for Middlesex was the Red-breasted Merganser, 1 male, Thames River, near Springbank Park, April 27th.

Observed in Victoria County at or near Sturgeon Lake:
Aug. 9th, one Black-bellied Plover; Aug. 16th to 30th, at frequent intervals, Caspian Tern, possibly six at once; they were usually with the A. Herring Gull or Ring-billed Gull. Two specimens were taken, one young and one adult.

J. F. CALVERT, London, Ont.

FIRST RECORD OF *AMARANTHUS SPINOSUS* L. IN CANADA.

Amaranthus spinosus L., the Thorny Amaranth, was sent from Swansea, Ontario, August 23rd, 1912, to the Central Experimental Farm, Ottawa, for identification. As far as we are able to judge from the literature at hand and enquiries made, we are of the opinion that this is the first record of this weed in Canada. It is hardly a desirable immigrant, as it has caused considerable annoyance to agriculturists beyond our southern border.

Like the other species of Amaranth, or Pigweed, it is a coarse annual plant producing a large number of seeds. It differs from them in having a pair of stout spines in the axil of each leaf. These spines are from $\frac{1}{4}$ to $\frac{1}{2}$ inch in length, and no doubt would be extremely irritating to horses working in a field infested with this weed. A typical plant measured three feet in height with a root ten inches long and one inch in diameter, red in colour, graduating to white at the tip. The plant is very bushy in general appearance; the particular specimen in question had six branches from the base of the stem varying in diameter from $\frac{1}{2}$ to $\frac{3}{4}$ inch thick. The flowers are monoecious, the staminate being arranged in long and slender spikes and the pistillate in clusters in the axils of the leaves.—F. FYLES.

BEE WITH POLLINIA ATTACHED TO ITS FEET.

In the collection of insects in the Division of Entomology at the Central Experimental Farm, is a specimen of *Epeolus mercator*, a solitary bee, with the pollinia of a species of *Asclepia*, probably *A. syriaca*, attached to its feet. Each appendage consists of a small hard implement with two arms which grips the claws of the bee like a clip, and attached to this clip by ligature strands are the two pollinia which are in the form of translucent, yellow, horny, shining leaflets about one millimetre in length.

The flower of the *Asclepia* produces an abundance of easily accessible honey, and is consequently visited by many insects, but it is smooth and slippery and offers no convenient place for the insect to alight upon, so that the only way it can support its weight is by inserting its claws in the slits between the anthers where the clip-like bodies are situated. Endeavouring to obtain a firm hold the insect inserts its claws in the slit in the clip, and then when it withdraws its foot the clip comes with it and also the two pollinia of the adjacent stamens which

are dragged out of their niches. The pollen masses are conveyed on the feet to the stigmas of other flowers, the approaches to which lie through chambers concealed in the slits. When the foot is withdrawn the ligatures attaching the pollinia to the little clip are broken and the pollinia are left in the cavity while the clip maintains its grip of the claw.

Further particulars of the process of fertilization in the Asclepiadaceae may be found in Dr. Oliver's translation of Prof. Kerner's "Natural History of Plants," from which much of the information here given has been extracted.—F. W. L. SLADEN.

A NOTE ON THE NORTHWESTERN DISTRIBUTION OF THE SUGAR MAPLE.

BY O. E. JENNINGS, B.SC. (AGR.), PH.D., CARNEGIE MUSEUM,
PITTSBURGH, PENNSYLVANIA.

As the current manuals are not definite as to the northwestern distribution of the Sugar Maple (*Acer saccharum* Marsh.) it is probably worth while to note its occurrence near Fort William on the northwestern shore of Lake Superior.

It became the writer's good fortune to spend three months botanizing along the northern shore of Lake Superior during the past summer. The region explored extended from Fort William on the west to Heron Bay on the east, and a delightful region this is for a botanist or nature lover in any form. Upon becoming acquainted with Chief Penassie of the Fort William Indian Reservation, the writer soon found him well versed in the distribution of many of the native plants of the region. Mr. Penassie was kind enough to point out a rather obscure trail leading up through a narrow defile in the mountains about four miles south, and a little west, of Fort William, where is located a colony of perhaps fifty sugar maples. The maples are well protected by precipitous walls on either side of the defile, which is here about one-third of a mile wide, and they are on a shelf at an altitude of probably 1,500 feet above the sea, in well-drained soil.

The trees are mostly rather gnarled and, from the fact that a number of saplings were found on the outskirts of the colony, it would appear that the colony is now spreading and that the sugar maple may have been a rather recent immigrant into this particular location. At the bases of the trees there are deformations, due to the rather crude method by which the Indians have been obtaining the sap. A birch-bark teepee is

located in the grove and there the sap is gathered and boiled. The sap is obtained by cutting a chip out of the base of the tree, inserting a thin chip in a nick cut in the bark just below the larger incision, and placing below the point of the chip a crude bucket formed by folding upwards the ends of a piece of birch bark. The ends of the birch bark are kept in the folded position by means of thongs of spruce root. This crude but serviceable bucket catches the sap as it flows out of the hacked wound and drips off of the end of the slanting chip, and the sap thus caught is easily carried to the teepee.

BOOK NOTICES.

COMPARATIVE ANATOMY OF VERTEBRATES.—By J. S. Kingsley; 401 pages, 346 illustrations. Price \$2.50 net. P. Blakiston's Son & Co., Philadelphia.

We have here a really good elementary text on Comparative Anatomy of Vertebrates. The subject matter of the introduction is well chosen, and includes just the proper groundwork for the later study. The first 120 pages are devoted to the Integument and the Skeleton. The discussion is clear and comprehensive, and particularly well illustrated. There is a short but excellent discussion of the Coelom, pages 121 to 124. I was somewhat disappointed in the section on the Muscular System, pages 125 to 136. As a short discussion, this section is excellent, but a more complete account would seem to me justified in a text of this kind. The Nervous System and the Organs of Special Sense, are dealt with on pages 137 to 205, and receive excellent treatment. Several of the new diagrams here presented will prove very acceptable to both teacher and student. I should have preferred a discussion of the human brain at the close of the section on that organ. The Digestive, Respiratory, Circulatory, and Urogenital Systems occupy the remaining half of the book, and receive capital discussion. The many new diagrams, some of which are particularly useful, add appreciably to the value of the text. There is a well chosen Bibliography at the close, and a valuable series of Definitions of Systematic Names. The book is altogether an excellent one. The author has compressed an immense amount of information into its 400 pages, and has presented it in a very clear manner and with logical sequence. It will fill a decided need in the teaching of comparative anatomy. The publishers are also to be complimented on the excellent appearance of the work. It is of the ideal size, shape and strength for a student text.

J. M. S.

PLANT BREEDING IN SCANDINAVIA.—By L. H. Newman, B.S.A., Canadian Seed Growers' Association, Ottawa, 1912; 193 pp., with 63 illustrations (photographs, diagrams and tables) in the text. Price \$1 (cloth \$1.50).

In this book the author, for many reasons, has confined his investigations largely to the work which is being prosecuted at the plant breeding station at Svalof, in southern Sweden. This work became known to English speaking nationalities chiefly through Hugo de Vries' well known book "Plant Breeding," published in Chicago, 1907; but unfortunately the information given in the said book, and the conclusions drawn from statements made, were not in full accordance with the actual work and results at Svalof. The same can be said, more or less, of practically all accounts of the above work published outside of Scandinavia.

Any charges of the kind indicated cannot be laid against the book presented by Mr. Newman. On the contrary, the statements made and the conclusions drawn are in most perfect accord with the actual facts and can therefore be accepted with absolute confidence. The accuracy and completeness with which the different problems have been treated, do the author the greatest credit. They are due to his efforts "to know what is true in order to do what is right," a most difficult task in this particular case, as practically all original publications on the breeding work at Svalof are published in Swedish, a language which it requires hard and untiring efforts to become familiar with.

The book deals not only with the plant breeding methods, as they have been developed in Scandinavia, but it also gives in concise form a general survey of the different theories on which breeding methods are based. For this reason it becomes of interest to all students in any way connected with the study of breeding in general.

M. O. MALTE.

ONTARIO NATURAL SCIENCE BULLETIN, 1912; Journal of the Wellington Field Naturalists' Club, Guelph, Ont.

We were glad to receive, recently, Bulletin No. 7, of the above club. This annual publication contains contributions of much interest to naturalists in Canada. In the present issue of 77 pages, the following articles appear: The Myxos of Middlesex, by John Dearness; The Plant Formations of the Bruce Peninsula, by A. B. Klugh; Ginseng and its Diseases, by H. H. Whetzel; The Rosaceæ and Leguminosæ of Galt, Ont. and Vicinity, by W. Herriot; Jungle Life on the Hills of South India, by G. J. Spencer; Liliaceæ of County Peel, by J. White; The

Bartramian Sandpiper Breeds near Guelph, by Herbert Groh; The Flora of the Sand Dunes of Prince Edward County, by A. B. Klugh; Food Habits of the Bullfrog, by E. W. Calvert; The Edible Toadstools—The Smooth Lepiota, by W. A. McCubbin; Weed Migration, by F. Mitchell; An Addition to the List of Toronto Butterflies, by Arthur Gibson, and Notes on the Mammals of the Bruce Peninsula, by A. B. Klugh. A. G.

HOUSE-FLIES AND HOW THEY SPREAD DISEASE.—By C. Gordon Hewitt, D.Sc., Dominion Entomologist. Cambridge; at The University Press, 1912. Price 1s. net. New York Agents: G. P. Putnam & Sons, 2-6 West 45 St., New York.

This volume of 122 pages, one of the series of the Cambridge Manuals of Science and Literature, has recently appeared. It is replete with concise, accurate facts concerning the subject of house-flies and disease, a subject which every day is becoming of more vital interest to every wide-awake citizen who values the health of the community in which he resides. There is no more deadly and rightly much abused insect than the house fly, and such reliable information as is contained in this volume will do much towards making wider and better known the habits of this "potential disease-carrier and constant frequenter of filth."

The volume is divided into two parts. Part I—The Natural History of the House-fly, contains six chapters: I—Introduction; II—The Structure of the Fly; III—The Life-history and Breeding Habits of the House-fly; IV—The Habits of the House-fly, V—Other species of flies found in houses: The Lesser House-fly; The Latrine-fly, The Stable-fly, The Blow-fly or Blue-bottle, The Cluster-fly, and *Muscina stabulans* (which has not yet received a popular name); VI—The Parasites and Natural Enemies of the House-fly: *Empusa muscæ*, Chelifers, mites borne by the House-fly, Thread-worm parasites, Protozoal parasites, and Insect Enemies. Part II.—The Relation of House-flies to Disease, embraces chapters VII to XI. Chapter VII deals with The Carriage and Distribution of Micro-organisms of Flies; VIII—The Dissemination of Typhoid Fever by Flies and their Relation to Summer Diarrhoea; IX—The Relation of Flies to certain other Infectious Diseases: Tuberculosis, Ophthalmia, Cholera, Plague, etc.; X—House-flies in relation to (1) Myasis of the Intestinal and Urinal tracts, and (2) The Spread of Parasitic Worms; XI—Preventives and Control Measures.

In the text there are 19 illustrations, the author being responsible for all with the exception of two. The general appearance, the printing and the paper used in this manual are all excellent, and what will please the lay mind, there is a total absence of all technical terms. A. G.

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A NEW CANADIAN CIRRIPEDE, PARASITIC ON A SHRIMP.

(Resumé of Mr. F. A. Potts' research at B. C. Biological Station).

By PROFESSOR E. E. PRINCE, Commissioner of Fisheries.
Ottawa.

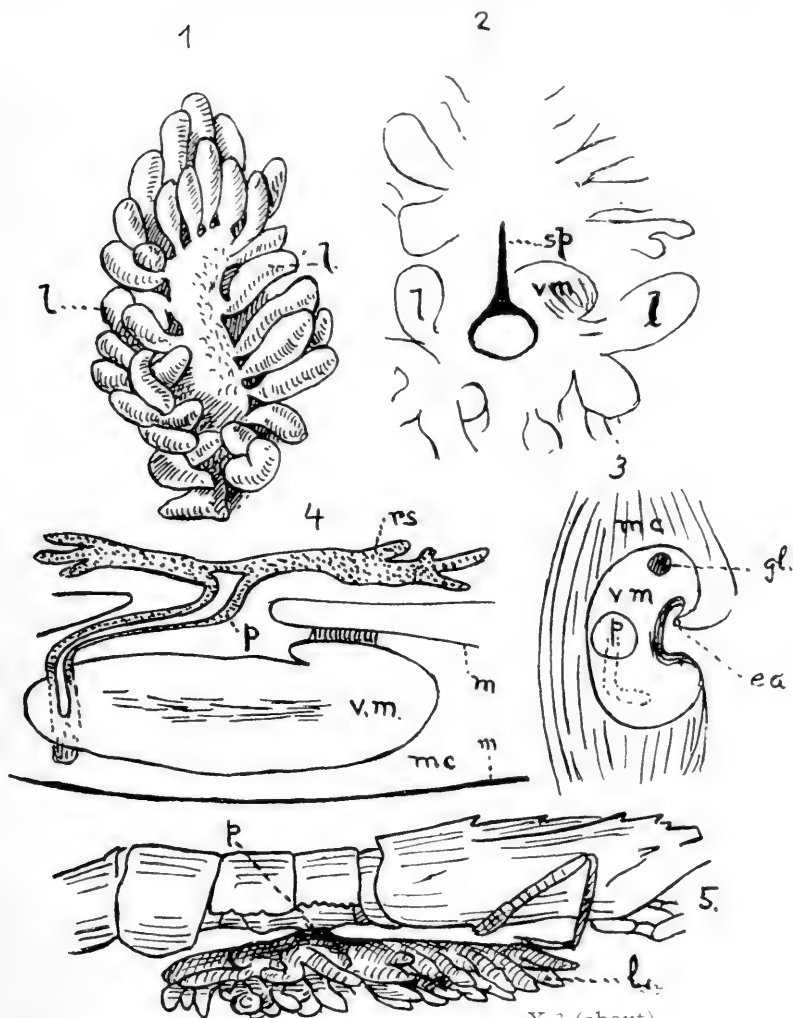
The naturalist who spends hours on the sea-shore, now and then finds specimens of shore crabs, on the under-side of which is attached a yellowish brown mass, resembling a small potato. This soft rounded lump is really the mature stage of a parasitic crustacean. Just as a pug and a greyhound show dissimilarities, though a child knows that both are dogs, so this sac-like parasite is a crustacean, a member of the Order Cirripedia or Barnacles, which Order, Dr. Starr Jordan says, furnishes an example of "degeneration through quiescence . . . the barnacles being most nearly related to the crabs and shrimps." Charles Darwin gained early fame by his studies of the Cirripedes, and his monograph on the Order is a classic of zoological science. In early life each passes through one or more active stages, and later becomes fixed and wondrously transformed. The transformation is one of degeneration, but while the barnacle (Fam. Balanidæ) is strange enough in its changes, the sub-order Rhizocephala furnish us with the most extraordinary examples. The sac-like parasite referred to above is rightly called *Sacculina*. It comes from the egg as a minute water-flea called a Nauplius, and changes into the more complex Metanauplius, and after swimming about freely it attaches itself to a crab, penetrates the crab's shell with one of its hollow antennæ. Now follows one of the most marvellous circumstances in the entire range of biology. The whole of the soft contents of the Cirripede's body is squeezed through the hollow tube or antenna into the body of the crab, rather recalling a cat squeezing its way through a small drain pipe. Soon it works its way to the intestine of the host, but later pushes to the exterior, hanging on as a sac, below the crab by a short peduncle. The top of this neck shows branching roots, which penetrate the organs of the crab,

extend into its jointed limbs, and thus form a most elaborate network for absorbing the fluid nutriment from its host. The bunch of roots may form a compact matted mass in *Peltogaster*. The crab, though apparently incommoded by this fleshy bag attached to its body beneath, seems not to suffer greatly, but it does not grow much, as moulting of the hard shell is arrested. "Fortunately," says Dr. Arthur Shipley, "*Sacculina* appears to live only three years, and when it dies the crab resumes its growth," but some recent researches by Mr. C. G. Robson point to the death of the crab in some cases, owing to starvation; the fatty materials left being insufficient for its necessities. Professor Giard found in the helmet crab (*Stenorhynchus*) that the penetration of the cirripede-parasite caused the destruction of the ovaries and the spermaries. In the latter event, the male crab assumes some of the features of the female and exhibits a broader tail and smaller pincer claws; but in the female crab, the abdominal feet become smaller in size as in the normal male. The studies of Dr. Geoffrey Smith show, on the other hand, that more yolk-forming material (as in a female crab about to spawn) results in a crab with *Sacculina* attached; and Mr. Robson found an excessive production of fat in the liver and blood in affected crabs of both sexes, resembling the condition of the male when about to cast his shell; or, in the female, resembling her condition when maturing her eggs before depositing them.

It has been reserved for Mr. Potts, a Fellow of Trinity Hall, Cambridge, who came over from England, early in 1911, to pursue marine researches at the Dominion Biological Laboratory, Departure Bay, near Nanaimo, B.C., to discover a new Cirripede, which surpasses all previously described species in its strange structure and life history.* Mr. Potts' main purpose was the study of the Annelids of the Pacific, and his investigation of this new parasitic Cirripede was a subsidiary piece of work, and abundantly shows what interesting original discoveries await biological students who will spend a season or two at any of the Biological Stations of Canada.

Called by Mr. Potts *Mycetomorpha vancouverensis*, this new species, for which indeed a new genus *Mycetomorpha* had to be established, appears as a fungus-like sac on the under-side of a Pacific shrimp (*Crangon communis*, Rathb.), close to the basal joints of the abdominal limbs. (Figs. 1 and 5). In form it is an elongated sac, $\frac{3}{4}$ in. long and $\frac{1}{8}$ in. wide, and beset along the margin by crowded club-shaped lobes, over fifty in number. (Fig. 1 L.) The sac is very thin-walled, a delicate muscle-layer being indicated by faint striations, through which the round

* See Mr. Potts' paper in Spengel's Zoologisch, Jahrb. 1912, pp. 575-594, 2 Pls.



X 3 (about).

- Fig. 1. *Mycetomorpha* viewed from the ventral, lower side.
 Fig. 2. *Mycetomorpha* upper or dorsal side, showing chitinous ring around the peduncle, and anterior spike.
 Fig. 3. Diagram showing position of some organs, and bay on one side where mantle duct opens (ea).
 Fig. 4. Diagram of visceral mass, peduncle and roots in section.
 Fig. 5. Diagram of side view of *Mycetomorpha* attached to the shrimp.
- ea. external aperture of duct
 gl. modified colleterial gland
 l. lobes of *Mycetomorpha*
 m. mantle
 mc. mantle cavity
 p. peduncle of attachment
 rs. root-system
 sp. chitinous spike
 vm. visceral mass.

visceral mass is visible, on the left side. The creature has no mouth or digestive canal, or other organs, excepting the egg-producing gland which consists of ovarian follicles between thin muscular septa, each follicle containing a syncytium or mass of united protoplasmic bodies, showing small deep-staining nuclei (the oogonia) and larger nuclei, which are centres of oocytes. Small vacuoles or spaces are present in each oocyte, but there is no trace of yolk in any of these primitive developing eggs. Egg-shaped bodies, much larger than the young eggs, occur in the ovary and in the ventral part of the sac or mantle cavity. These bodies exhibit a central mass of small cells, with nuclei, and a thin cuticle (like the embryonic cells of the Cypris-larvæ described later) around which is a yellow layer of globules, really yolk, outside of all being an external cuticle. There also occur, in the developing eggs, two or three vacuolated cells, each having a darkly staining nucleus. Mr. Potts could find no trace of spermaries, and he concluded that the species is parthenogenetic, the eggs in the ovary, in his opinion, hatching out embryos resembling the Ostracod, *Cypris*, and these migrating between the muscular layer and the inner ectoderm of the mantle, break through the latter, and then assume the form and structure of the Cypris stage. Among the Cypris-larvæ in the mantle cavity are large cells which may be degenerated ova, probably from the mantle wall, these having dropped into the mantle cavity. Mr. G. W. Smith found that in *Sacculina*, as Mr. Potts tells us, a few unfertilized eggs remained in the ovary after most of them had reached the mantle cavity; but, in *Mycetomorpha*, these developing eggs are in an advanced segmented condition, and so uniform in structure as to preclude any suggestion that they have degenerated.

On the left side of the thin-walled mantle sac is an indentation or bay, where a small round orifice occurs, (Fig. 3 *ea*) the exit of a duct, which curves round the visceral mass, and exhibits an internal opening or outlet from the mantle cavity. Through this duct some larvæ may be expelled, but it is unlikely, the walls being so thin and delicate, and lacking the strong musculature seen in *Sacculina* and *Peltoaster*, in which species the larvæ are forcibly ejected from the parent. Mr. Potts thinks that the larvæ escape in *Mycetomorpha* through apertures formed by the thinning away of the mantle at certain points. In the two Rhizocephalans, referred to, special colleterial glands secrete tenacious matter to bind the eggs in a mass and attach them to the mantle, and in this new form two disc-like patches occur on the upper (Fig. 3 *gl*.) and lower surface of the visceral mass, which from their position, etc., appear to correspond to such glands modified, and now secreting yolk-matter and nourishing

the growing ovary. This view is supported by the fact that they were in functional activity though the eggs had just been extruded, and the new series of eggs were in a very early stage.

As already stated, the eggs give origin to embryos which develop into active little crustaceans exactly like free-swimming Ostracods or water fleas (Cypridæ), possessing a transparent bivalve shell and numerous paired limbs, and crowding the capacious mantle cavity, until they finally find their way into the external water.

Sylon, a Rhizocephalan, parasitic on shrimps, is known to reproduce parthenogenetically, and the same doubtless applies to *Mycetomorpha*, as Mr. Potts found no trace of any male organs.

Mycetomorpha lives upon the juices of its host which are sucked in by the short branches of the root-system (Fig. 4 *rs*) and carried by a hollow space or lacuna into the short oblique peduncle (Fig. 4 *p*.) or neck of attachment to the shrimp, this neck being as usual strengthened by a ring of hard chitin, from which a median spike projects forward. (Fig. 2 *sp*.) The upper branching part or root-system of the peduncle (Fig. 4 *rs*) appears like a matted strip of short branches given off laterally along the under side of the great ventral nerve cord of the shrimp, these terminating in the ventral muscles. The root-system does not penetrate the host extensively, like *Sacculina*, but extends only about a segment and a half of the body in front of the peduncle and less than a segment behind the peduncle.

Mycetomorpha is a most interesting addition to the marine fauna of Canada. Like other Rhizocephalans it is, when adult, a most degenerate animal, with its rounded shapeless body destitute of limbs, sense organs, mouth and digestive canal, gills, heart or blood-vessels. Clinging tightly to its host by its peduncle with branching extensions, it sucks the nutrient juices, and devotes its sluggish energies to producing eggs, but in the absence of a male, these are parthenogenetic, and they give birth to embryos, which skip some of the larval stages of other Cirripedes, and appear in the mantle or brood cavity as active swimming Cypris-larvæ, and seem to then burst through the skin of the parent to wander about in the open waters of the sea.

Carl Claus said of the Crustacea, as a whole, that their development from the egg is "almost never direct, for it is rarely that the young, after hatching out, possess the form which they will have when adult. Almost always there is a complicated metamorphosis, and when they are destined later to live the life of parasites, the metamorphosis is regressive." *Mycetomorpha*, in its young stages, could hardly be more unlike its adult form, and in its development and mode of life it is a remarkable illustration of degenerative evolution or regressive development.

NEW OR RARE BIRD RECORDS FROM MANITOBA,
1912.

BY NORMAN CRIDDLE.

The following notes refer chiefly to birds that have not hitherto, so far as I am aware, been recorded from the Province of Manitoba, and all are new to the fauna of Aweme.

SAY'S PHOEBE, *Sayornis saya* (Bonap.) Baird.

An example of this bird was secured by my brother Stuart, on April 23rd, close to some deserted farm buildings, and another one observed three days later. A bird almost surely of the same species was heard uttering loud cries in an old barn the previous year, but made its escape before it could be observed closely. Others have also been seen from time to time in past years, but the above constitutes the first authentic record east of Saskatchewan.

It has, however, been found breeding in North Dakota as well as from Saskatchewan westward to the coast, so there is good reason for expecting that it will eventually be found nesting in Manitoba also.

OBERHOLSER'S HORNED LARK.

This bird, known scientifically as *Otocoris alpestris enthymia*, was found breeding in company with a colony of Chestnut-colored Longspurs; a specimen was also collected by my brother, Stuart, on a ploughed field in April. He submitted two to Mr. Oberholser, who determined them as above.

This race, to judge from the latest Check List, has not yet been recognized as valid by the A. O. U., so may very possibly intergrade with other forms found further west. In Manitoba its nearest ally seems to be *praticola*, from which it is very difficult to separate during the migratory seasons. When breeding, however, it selects the open prairies, while the Prairie Horned Lark confines itself more to the broken wood-lands, where there are small plains or bare hills surrounded intermittently with trees, though it seldom, if ever, seeks shelter in or among the trees. When better known, *enthymia* will probably be found to be quite a common breeding bird in the province.

Another horned lark, the Pallid, has also been identified from Aweme by Mr. Oberholser, which adds yet another to the local list, though previously collected and recorded for Manitoba. Thus to date we have records of four races, *praticola*, *arcticola*, *enthymia* and *hoyti*, while Mr. Seton enrolls a fifth, *alpestris*. Probably at least one other, *leucolæma*, occurs here also.

From time to time birds of usually more southern latitudes extend their range northward and for a time at least become domicile, occasionally permanently so, as the Square-tail, or Prairie Chicken of the south, which is now even more numerous than the native Sharp-tailed Grouse in the open country. The Bluebird, on the other hand, for a few years became fairly numerous and then gradually decreased again, though it is yet found breeding in small numbers. The Purple Martin is another fluctuating species. Yet another that has recently moved north and eastward is the Arkansas Kingbird. Dr. Speechly records two pairs as nesting at Pilot Mound both this year and last, while we at Aweme have seen two, and a pair are breeding only a few miles away in the village of Treesbank in some trees surrounding a house. The bird is not uncommon in the southern portions of the provinces to the west of us.

MEETING OF THE BOTANICAL BRANCH.

The first meeting for this winter of the Botanical Branch was held at the residence of Mr. R. B. Whyte, 370 Wilbrod St., on Saturday evening, November the 30th. There were present the following members: Dr. Malte, Messrs. J. M. Macoun, W. T. Macoun, L. H. Newman, E. D. Eddy, James Lawler, A. Eastham, J. W. Gibson, A. E. Attwood, J. J. Carter, J. W. Eastham, W. Dreher, H. A. Honeyman, F. T. Shutt, T. E. Clarke and Dr. E. H. Blackader.

The subject was "A Summer in Britain", by the Chairman for the evening, Mr. Whyte. He illustrated his observations by lantern views taken during the course of his trip; and he had about seventy-five very interesting photographic plates that were thrown on the screen by Mr. J. W. Gibson.

He travelled in company with Prof. Hutt of the Ontario Agricultural College, Guelph, and they went direct to London, where they made their headquarters during the five weeks they spent in England. From there they made daily trips in and outside of London, wherever they had an opportunity of studying the methods of horticulture and of decorative gardening as practised there.

Their first visit was to Covent Gardens Market, where they were amazed at the extent and variety of the fruits and flowers for sale. One section was entirely devoted to wild plants and flowers, natives of Great Britain. Other sections were devoted to small fruits such as strawberries, gooseberries, currants, raspberries and loganberries, and he remarked on the fineness of their quality, especially of the strawberries. One producer

told him that he sent in fifty tons of strawberries daily during the season, besides other products. Some of the persons he met either invited them to visit their estates and study the methods of cultivation, or gave them letters of introduction to the owners of large estates where there was something to be learned; and Mr. Whyte remarked on the unfailing courtesy and hospitality with which they were received and entertained merely on the strength of such letters. He then gave his impressions of the methods of cultivation.

A great deal of time and labour is given to the training and pruning of the small fruit bushes. The lower shoots are all cut off, and the upper branches are not left to topple over and drag their fruit in the ground, but so that plenty of sunlight and air gets in to ripen the fruit. He also illustrated on the screen the care that is taken of the larger fruit trees, and how carefully they are pruned and protected. And yet these trees do not look as healthy as ours. They are planted too close, and with shrubs or perennials between, and the trees are covered with moss; and Paris green as a destroyer of insect pests is practically unknown.

At some of the large estates they took photographs of the special "show gardens," where the owners displayed their artistic fancies for pleasure and beauty, and not for productiveness. For instance, there was shown the Japanese garden, the Elizabethan, the water, the rock, and many other peculiar and beautiful gardens.

Another group of views illustrated English country life: the well-kept but narrow road, with no sidewalks, with hedges instead of fences, and often bordered with flowers. The private residences of any pretention were rarely visible from the road; they would be carefully screened by trees, and only the gate with the name of the estate on the gate-post was seen. But these names were well-known and served the purpose of street numbers.

One of their most interesting trips outside of London was when they were invited as the guests of the Horticultural Club on their annual outing, which this year was to Stoke Poges, Burnham Beeches, and Clevedon, the home of Mr. W. H. Astor, and winding up at East Burnham, the residence of Sir Harry Veitch, the President of the Club. The beech trees at Burnham Beeches are pollards, that is, with very short trunks, which in the course of several centuries have grown to great girth, and assumed weird and fantastic shapes.

Another trip was to Bagshot, the private residence of H. R. H. the Duke of Connaught. This place is famous for the great variety and beauty of ornamental trees. And there were

many other trips of which Mr. Whyte spoke enthusiastically, such as a trip up the Thames, to Kew Gardens, a walk up Box Hill, to Linten Hoo, to Gunnesbury House and Aldenham House, all of which one must visit one's self to thoroughly appreciate.

E. H. B.

A FORM OF *LINARIA VULGARIS*.

In the summer of 1910, in the neighbourhood of Toronto, I discovered a form of *Linaria vulgaris* that seems to be very unusual, at least I have met with no one who has seen it and so far I have not heard of any one who has found this form. The corolla is perfectly white and completely spurless. So far as I have yet discovered, the plant does not set seed.

The calyx seems to have undergone no change, but the corolla is regular. Its two-lipped appearance is wanting and the lobes of the gamopetalous corolla are nearly equal in size. The four stamens and the pistil seem to be perfect, yet so far I have failed to find a perfect capsule with seeds. The plant must spread by its underground runners.

My attention was first drawn to the plant by its whiteness. At first I supposed I had found a plant unknown to me, but on closer examination I came to the conclusion that it was a form of *Linaria vulgaris*. I was soon confirmed in this belief by finding another patch of it in which some of the plants had the white spurless corollas and the ordinary form of the corolla on the same stalk, the white regular form being always below the spurred form. It seems to be well established, for in 1911, and this summer, the variety is as abundant as ever. There are a number of patches of this peculiar form extending through fields and along the road for a quarter of a mile. The patch first discovered had only the variety growing in it and was at least 20 feet long by 4 feet wide and it had hundreds of plants growing in it.

W. SCOTT, TORONTO.

The above form is of much interest owing to the fact that it represents a spurless type of that monstrosity generally known as *Peloria*. This variation, which is merely an aberrant form of no systematic value whatever, is characterized, as is well known, by the presence of five spurs in the corolla. These *Peloria* types are merely accidental. They are to be found especially in autumn on specimens which had been mowed or pastured during the summer and, as a rule, they occur in the same head as typical irregular flowers.

M. O. M.

THE HOODED MERGANSER NESTING IN SOUTH-WESTERN ONTARIO.

While examining the collection of living ducks and geese in the possession of Mr. Roswell Goldie, at Guelph, in December, 1912, he told me that a nearby farmer reported to him in 1908 or 1909 that he had found a wood duck's nest and promised to bring the eggs in for hatching.

Mr. Goldie is much interested in raising these birds and has a scheme for the liberation of some of them in spring so as to help to increase the native stock. He was therefore anxious to get these eggs to raise along with others laid by his own female wood ducks. The farmer brought them in, in due time, but Mr. Goldie suspected that they were not the eggs of wood ducks, and when they were hatched they turned out to be Hooded Mergansers. He worked overtime in trying to supply them with fish and worms in sufficient quantities, but failed to be able to keep them alive, although they ate greedily.

I do not know that there is any authentic record of this bird having bred in lower Ontario in recent years, which makes this occurrence very interesting. It is of course certain that this, as well as the larger Mergansers bred all over Ontario in former years, and that they still nest annually in the more remote parts of the country, but authentic instances are always important, and for lower Ontario, are very few in number.

W. E. SAUNDERS, LONDON, ONT.

THE PRAIRIE DEER MOUSE AT LONDON.

The Prairie Deer Mouse, *Peromyscus michiganensis*, has been known for several years to be very common along the shore of Lake Erie near Point Pelee. Its range has been extended by means of specimens taken near Chatham and at the south-east corner of Lake Huron, but it has not previously been reported from the central part of the Western Peninsula.

On December 12th, I found one of these mice in a trap in my back yard in London. It had apparently been living for a short time at least under a shed where my wood ducks shelter, and had doubtless been feeding upon the grain for the ducks.

If we accept the probability that this mouse is a recent introduction to Ontario it will naturally follow that its further spread is to be expected. There is little doubt that a slight search would show its presence along the lake shore much farther east than Point Pelee, and it might even be traced as far as the Niagara Peninsula, as the circumstances all along the lake shore are favorable for its spread.

W. E. SAUNDERS, LONDON, ONT.

BOOK NOTICES.

WORK OF THE CANADIAN BIOLOGICAL STATIONS. Contributions to Canadian Biology, being Studies from the Marine Biological Stations of Canada, 1906-1910. Ottawa. C. H. Parmalee, Printer to the King's Most Excellent Majesty, 1912.

A handsome well-bound volume of over 300 pages, which bears the title given above, has just been issued by the Dominion Government. The two preceding volumes of Biological papers, Supplements to the Annual (Fisheries) Report of the Department of Marine and Fisheries, appeared in 1901 and 1907; but the present volume is a great advance upon the slim blue books just referred to. The increased generosity shown by the present Government, and the great personal interest shown by the present Minister of Marine and Fisheries have, no doubt, much to do with the great advance shown in the present Biological Volume.

To all naturalists, and especially to persons interested in fishery researches, and in investigations into the life in the sea, this report will be welcome. It includes 19 papers, with 38 plates, two of them maps; and the excellent paper, the strong binding, and above all, the really beautiful plates, most of them works of art, add to its importance as a Canadian biological publication.

Professor Prince, Dominion Commissioner of Fisheries, as Chairman of the Biological Board, furnishes an interesting preface, and claims that the Canadian Stations occupy a premier place in showing substantial results, after so short a time of operation, and with so vast a field to cover as the waters of the Dominion.

It is difficult to review a scientific volume of such varied contents as this, but it may suffice to summarize them as Narrative (like the articles by Professor Prince and the late Professor Penhallow) Practical, Faunistic, Botanical, Physiological, Physical and Geological.

Among the practical fishery papers Professor Knight's (Queen's University, Kingston) takes first place. Bait is the most vital need of our fishermen, especially sea-fishermen, and Professor Knight reports fully his experiments on bait. From these it appears that fresh clam-bait is best, frozen clams less so, while herring bait comes next, fresh herring being rather better than frozen. Squid-bait ranks next, while the flesh of the detested sea dog-fish (*Squalus acanthias*) proved to be very attractive. Professor Knight's style is very fascinating, and his references to fishermen's theories very amusing. He embodies a large amount of valuable matter in the ten pages of his report.

Like his previous papers on "The Effects of Explosives on Fish-life" and his reports on "Sawdust and other Water Pollutions," Dr. Knight's present paper shows thoroughness and originality, and his exposition is most lucid. Professor McBride, late of McGill University, contributes a practical report on Oyster Culture, and refers also to the hardly less important Clam Fishery, the value of the latter in 1911-12 reaching \$332,803, whereas the oyster fishery only brought \$212,296. Dr. Joseph Stafford reports on an interesting piece of work, which the Biological Board gave him to do, viz., the study of the young stages of the oyster and other molluscs. Embryologists are of course familiar with the larval stages of the chief edible shell-fish in our waters, but some points remained which it was desired by the Biological Board should be cleared up, and the paper on the "Recognition of Bivalve Molluscan Larvæ" fills the lacuna. Dr. Stafford had previously investigated the Soft-Shell Clam and his report in the "Contributions" published in 1901, was valuable and illustrated by four beautiful plates, but the present three plates, with 44 figures, though heliograph reproductions, are much inferior, and somewhat coarse, showing little of the clearness of detail, such as one sees in the drawings of British, Dutch and German specialists, for example Dr. John Wilson, Dr. Hoek, Lovén, and others. Dr. Stafford followed precisely the method of the early investigators into larval fish-life in European seas, for they artificially fertilized and hatched sea-fishes' eggs, and reared them through early stages, and the latter stages were connected with these by securing the older stages in plankton nets in the open sea. Dr. Stafford's detailed descriptions of the young soft-shell clam (*Mya*), the hard-shell clam (*Venus*), the scallop (*Pecten*) and the oyster (*Ostrea*) are valuable, and he usefully adds the Silver-shell (*Anomia*), the young of which has often been mistaken for the young of the oyster. Dr. Stafford provisionally determines certain larvæ as those of *Tottenia* and *Clidiophora*, and gives six figures of them.

Professor L. W. Bailey (Fredericton, N.B.), reports on Diatoms, which form part of the food of the oyster and other shellfish, though less extensively than was at one time claimed. His interesting notes, chart of distribution, and plates, with 53 figures, admirably supplement the preceding molluscan papers. Dr. Stafford continues his Atlantic Fauna papers and adds to the lists of previous workers, giving three lists of the various classes from Protozoa up to Polyzoa, Molluscs, Tunicates and Vertebrates. A less discursive and thoroughly accurate list of our Atlantic marine fauna is a *desideratum*, and Dr. Stafford's three further papers now published will help towards that end.

Dr. A. T. Huntsman's memoir on Pacific Ascidians is in some respects the most important paper in the volume. This accomplished Toronto lecturer on Zoology has done admirable work at St. Andrews and at Departure Bay, B.C.; and this thorough, though somewhat technical, account of Holosomatous Ascidians from the coast of Western Canada will add to his reputation. It has been stated that German specialists are already anxiously inquiring for copies of this important paper. Finer scientific plates have rarely been published in Canada, than the 21 heliograph plates, with 100 figures, which illustrate and embellish Dr. Huntsman's notable report. The Tunicates are largely devoured by the cod tribe, and other fishes, but this paper, in this respect of practical value, has also a value purely scientific, and its importance may be judged from the fact that, of 35 species described, no less than 18 are apparently new to science.

Hardly less important is Professor C. B. Smith's paper on "Parasitic Copepods from Nanaimo," illustrated by seven plates. These were collected by the late Rev. George W. Taylor, and of 14 species described, over half are new to science. The figures are outline reproductions, but so remarkably clear and accurate, that it is a pleasure to consult them. This paper, like Dr. Huntsman's, is of exceptional value, and it marks a notable advance in the study of Canadian Crustacea. Dr. Smith refers to the late Mr. Taylor's assiduous work, and rightly says that the present account of Copepods, parasitic on fishes, has great economic interest as well as scientific value. The Rev. Mr. Taylor, shortly before his lamented death, had made and studied a large collection of Crabs and other British Columbia Decapods, and compiled a list of 129 species, which is published in this volume. It is a valuable and most remarkable piece of scientific work. Following Mr. Taylor's list, there appears a short paper by Professor Charles H. Gilbert, of Leland-Stanford University, California, describing an interesting little fish, new to science, and named *Asemichthys taylori*. It was caught at the British Columbia Biological Station, and no other specimen is known, except the one secured by the late Mr. Taylor. Mr. Cornish (Toronto University), publishes some notes on Prince Edward Island fishes, and Mr. D. L. McDonald (McGill University), gives a short list of 35 species of Crustaceans obtained at St. Andrews.

Passing from the faunistic papers we notice an important physiological paper on the innervation of the lobster's intestine. It is very technical, and many readers will wonder what practical value it can have; but the more we know about the vital functions of this crustacean and highly esteemed article of food, the

better for the lobster industry. It is claimed that the Nova Scotia fishermen, who ship live lobsters to the New England markets, lose no less than \$150,000 per annum, owing to dead and sickly specimens in the lobster-crates. Also, the Canadian and United States Governments found considerable losses in attempts to transplant live lobsters to Pacific waters, where no lobsters have ever occurred. If we knew more about the nervous functions and blood circulation of the lobster, complete success might be accomplished, for some authorities are of opinion that the delicate sense-organs of the lobster are affected by the train's vibration, resulting in sickness and death *en route*. Professor Miller's paper is a first instalment, and with its six fine heliograph plates it is an important contribution to science. Mr. Klugh (Queen's University), reports on two months' botanical work, and his account of the flora of St. Andrews, especially the ecological notes, are of great interest. The paper extends from the lowly diatoms through the non-flowering plants up to the flowering plants and conifers, and the interesting views, and the plates of sections of leaves and stems, show how thoroughly the author has carried out his plan of study on the distribution of species; and the atmospheric, geological, and other causes, which are potent in that distribution.

The physical researches carried on by Dr. Copeland, of Toronto University, are summarized in a report on temperatures and densities, which bear on the suggested culture of oysters near St. Andrews, while Professor E. M. Burwash's paper on the geology of the locality where the British Columbia Station has been built is most interesting and is accompanied by a large geological map.

No one can peruse this beautiful volume, which can be obtained *gratis* from the Commissioner of Fisheries, Ottawa, Chairman of the Biological Board of Canada, without a feeling of pride. It is indeed surprising that our ablest zoologists and professors in our various universities will year after year, without practically fee or reward, engage in labourious researches at the three Biological Stations connected with the Marine and Fisheries Department, and prepare for publication such splendid reports as the volume of Biological Contributions now under review.

One melancholy reflection is unavoidable. Two contributors, Professor Penhallow and Rev. George W. Taylor, did not live to see their reports in this volume published. Professor Ramsay Wright, to whom the Biological Stations owe so much, has recently gone to live permanently in Europe. It is difficult to fill such vacancies, but if Toronto, McGill, Queen's, Laval, Manitoba, and our other Universities, will stimulate their

graduates to engage in original research at the Biological Stations, future volumes of memoirs, not inferior to this, may be looked for in future years.

Science Fellowships from our Royal Society, or Government Science Scholarships, would induce our best and most brilliant students to resort to the Biological Stations, which are unequalled in the world in providing splendid facilities for valuable research.

C.

SEA-FISHERIES OF EASTERN CANADA.—The Commission of Conservation has just issued a report on the "Sea-Fisheries of Eastern Canada" that is of more than passing interest to all who are interested in the fisheries of Canada. The volume, which is bound in cloth and illustrated in colours, consists of a report of the proceedings of the Committee of the Commission on Fisheries, Game and Fur-bearing animals, which was held in Ottawa on June 4th and 5th last. At this meeting a number of experts delivered addresses on different subjects relating to fisheries, and these were thoroughly discussed by the members of the Committee.

The following is a list of the addresses which the report contains:—

Chairman's Address, by Dr. C. C. Jones; Whitefish of the Great Lakes, by M. J. Patton, M.A.; Conservation of the Oyster, by Joseph Stafford, M.A., Ph.D.; The Lobster Fishery of Canada, by W. A. Found; Oyster Fishery of Prince Edward Island, by Hon. J. A. Matheson, K.C.; Needs of the Fisheries of Nova Scotia, by Dr. Howard Murray; Sea-Fisheries of Eastern Canada, by J. J. Cowie; The Shad Fishery of Canada, by E. E. Prince, LL.D.; Fish Culture in Canada, by W. A. Found.

The appendices contain a number of useful statistical tables respecting fisheries, especially whitefish and shad.

KILLING FROSTS.

Every plant has its own particular freezing temperature by which it is killed. In all cases it must be at least 2° C. (3° F.) below the freezing point of water (32° F.)

The experiments of Rein show that the critical killing temperature for *Musa ensata* is 2°.10 C. (28°.2 F.); for *Begonia*, 2°.26 C. (27°.9 F.); for Tulip, 3° C. (26°.6 F.); leaf-stem of Laurel, 3°.5 C. (25°.7 F.); of the Olive-tree, 4°.1 C. (24°.6 F.); of the Oleander, 5° C. (23°.0 F.); of *Celandine*, 6°.99 C. (19°.4 F.); of the Daisy, 7°.9 C. (17°.8 F.); of the Violet,

9°.3 C. (15°.3 F.); of the Saxifrage, 14°.2 C. (6°.4 F.); and of the black Hellebore, 15°.8 C. (3°.6 F.); that is, when the temperature in the inner part of the above plants has fallen to the respective temperatures. Only a few of the examined seed-plants show a lower temperature; e.g. the pontine Rhododendron, 23° C. (9°.4 F.); Ivy, 23°.3 C. (9°.9 F.); Holly (*Ilex aquifolium*), 24° C. (11°.2 F.); and the Yew, 24°.9 C. (12°.8 F.). The mosses are killed between 14° and 19° C. (6°.80 to 2°.2 F.); the lower vasculiferous plants, which live in water, are not killed above 15°.5 C. (4°.1 F.); those living on land even not above 31° C. (23°.8 F.); and the one bacterium experimented upon by Rein required 47° C. (52°.6 F.) for killing it.

The above temperatures are somewhat affected by the temperature to which the plants have been subjected for some time beforehand. For instance, potatoes that have been at a temperature for some time between 0° to 1° C. (32° to 30°.2 F.) are frost-killed at 3°.08 C. (26°.4 F.), whereas potatoes that had been kept for four to seven weeks at 22°.5 C. (72°.5 F.) were killed at 2°.14 C. (28°.1 F.), that is at .94 C. (1°.7 F.) higher temperature. And this is the case too with other vegetable products.

CORRESPONDENCE.

The Editor, OTTAWA NATURALIST:

Mr. Macnamara's interesting article on "Poison Ivy" in the May Number has only just come under my notice. Poison Ivy (*Rhus Toxicodendron*) is common in our local bush. To educate people in its characteristics I sometimes pick it and have it in the house for a few days. Cases of dermatitis ascribed to Poison Ivy are fairly common every summer. Surely an important point is missed in all discussions on this subject by neglecting the main underlying cause of this, as of so many other skin inflammations. This cause is the blood condition induced by auto-intoxication, a term now well understood by the medical profession. This is not the place to go further into details, but I may say that in my eleven years of western experience I find the best treatment is the preventive measure which cleanses the intestinal canal thoroughly and which instructs the susceptible individual in a right dietary. My belief is that very few people are susceptible to Poison Ivy if they protect themselves in this way.

H. M. SPEECHLY, PILOT MOUND, MAN.

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SOME CHANGES IN THE NAMES OF GENERA OF TRILOBITES.

BY PERCY E. RAYMOND.

The writer has viewed with some complaisance the recent signs of revolt against the rules regarding priority and pre-occupation as laid down by the International Zoological Congress, believing that among paleontologists, the English speaking ones at least, there was a general agreement to follow the rules. At the recent meeting of the Paleontological Society, however, I was surprised to find that many of the American paleontologists were following the rules in a half-hearted manner; that is, that they were willing that the names of unknown or relatively inconspicuous genera should be corrected if necessary, but if the name were at all well known, they preferred to adhere to the long established although incorrect name. Now the arguments in favour of accepting the first name given to a genus, provided that the name is accompanied by a satisfactory diagnosis enabling one to recognize the organism indicated, are too well known to require repeating, and I can add nothing to what has already been said. In discussing one of the cases cited below, that of *Cryptolithus* versus *Trinucleus*, a paleontologist who protested strongly against giving up *Trinucleus* admitted that if he himself had proposed *Cryptolithus*, and if, seven years later a more distinguished man had proposed *Trinucleus* to take its place, he would have objected to the adoption of the later name. In these days, we are very careful not to say "I want credit for my work," but it is a popular saying, "Give credit where credit is due," and as we say it, we are more apt to slap our own chest than our neighbour's back. Why not be true sportsmen, and do to our predecessors what we would like done to us? Incidentally, it simplifies matters for the systematist.

In regard to preoccupation, it does seem as though the rule requiring that there should be no duplication of generic names within the confines of the whole animal kingdom were a little unjust. In former days, when there were naturalists, it probably was a little trying to read a paper on *Amphion*, and not

find till halfway through that the writer was dealing with a moth, while the reader was searching for information about a trilobite. As specialization goes on, we paleontologists will probably forget that moths exist, so why not let each group have its own set of names? But such a thought immediately suggests the confusion that would inevitably result, and one is driven back to the present rules. That the following of the rules works a certain hardship, I am fully aware, but that it produces confusion, I deny. We all dislike a change, and we hate to see well known things travelling under unfamiliar names. But it is remarkable how quickly we assimilate new names, and, after we once get them, how pleased we are with our new possessions. The very fact that they are new and arouse antagonism in us, fixes them in our memory, and they are further emphasized, because we make it a point to tell everyone what a mess Blank is making of our old familiar genera.

As an illustration of how quickly new names are adopted, one may cite the cases of *Orthis*, *Strophomena*, and *Leptaena*. From 1847 to 1892, those names were constantly on the tongue of every American paleontologist. Between 1892 and the end of the century we had learned a new meaning for each of these names, and had also learned some two dozen new generic names for some of the species formerly known by the names cited. It is quite certain that if we of this generation would straighten out our system of names, the next generation would never realize that it had meant any struggle.

In preparing a review of some of the genera of trilobites for a publication soon to be issued, I have tried to eliminate some of the names, which, according to the rules, do not have a lawful standing. As the changes have affected some very well known names, I have been asked to prepare a statement showing the grounds on which the alterations were made.

Some of the cases are very simple and they may be presented first. Jaekel¹ has recently proposed ten new genera among the Agnostidæ, but six of the names have to be rejected, because he did not recognize prior workers in the field. He proposed *Paragnostus*, with *Agnostus rex* as the type, but this same species is the type of *Condylomyge*, Corda,² which must of course remain the proper name for this group. He further proposed *Dichagnostus* with *A. granulatus* as the type, thus duplicating Corda's *Pleuroctenium*, which must stand. Jaekel proposed *Mesagnostus*, with *A. integer*, Beyrich, as the type, but Corda had already used this species as the type of *Peronopsis*. *Miag-*

¹ Zeit. d. Deutsch. Geol. Ges., vol. 61, pp. 380-401, 1909.

² Prodrum einer Monographie der böhmischen Trilobiten, 1847.

nostus, Jaekel, has the same type-species, *A. levigatus*, Dalman, as *Lejopyge*, Corda. In none of these cases can there be any reason for accepting the new names proposed by Jaekel. Two of the other new genera founded by Jaekel were based on new species, but they seem, nevertheless, to be synonyms of two of Corda's genera. Jaekel proposed to found the new *Leiagnostus* on his species, *L. erraticus*, associating with it *Aagnostus nudus*, and others. Corda's genus *Phalacroma*, with *A. bibullatus*, Barrande, as the type, includes *A. nudus*, and Jaekel's *L. erraticus* has the same generic characters, so that there is no reason to displace Corda's old name. *Metagnostus*, Jaekel, was founded on another new species, named by him *M. erraticus*. This species differs in very minor characters from *A. glabratus*, Angelin. *Metagnostus erraticus* and *A. glabratus* have the same short glabella with faint basal lobes, and the same type of pygidium, as *Aagnostus tardus*, Barrande, which is the type of *Arthrorhachis*, Corda, and *Metagnostus* therefore seems superfluous. Unfortunately, *Paragnostus*, *Metagnostus*, and *Leiagnostus* are the genera which Jaekel considered typical of three of his new families, and their rejection forces the rejection of the family names derived from them. Corda's family name *Phalacromidae* would apply to the *levigati*, and, using the same types as Jaekel the *Paragnostidae* would become the *Condylopygidae*, and the *Metagnostidae* would be transformed into the *Arthrorhachidae*.

Barrande,³ Walcott,⁴ and Lake⁵ have pointed out that *Microdiscus*, Emmons, was founded on an immature specimen of *Cryptolithus* (*Trinucleus*), and is not, therefore, at all the *Microdiscus* of Salter, Walcott, and authors generally. Walcott has suggested that *Pemphigaspis*, Hall,⁶ may be the same as what is generally meant by *Microdiscus*, and so take its place, but he has not followed this course himself. The writer has recently examined the type of *Pemphigaspis bullata* in the American Museum in New York, and is unable to connect it with what we usually call *Microdiscus*. It therefore seems best to rehabilitate *Eodiscus*, as defined by Matthew,⁷ to include a part, at least, of the species now known as *Microdiscus*. *Eodiscus schucherti*, Matthew, from the Lower Cambrian of Troy, N.Y., thus becomes the type. The name *Eodiscus* was first used in manuscript by Professor Hart, and mentioned by Walcott,⁸

³ Bull. Geol. Soc. France, ser. 2, vol. 18, p. 280, 1861.

⁴ Bull. U.S. Geol. Survey, No. 30, p. 152, 1886.

⁵ Paleontographical Society, vol. 61, p. 30, 1907.

⁶ 16th Ann. Rept. N.Y. State Cab. Nat. Hist., p. 221, 1863.

⁷ American Geologist, vol. 18, 1896.

⁸ U. S. Geol. Survey, Bull. No. 10, p. 24, 1882.

but was not used in any definite sense until Matthew's publication.

The case of *Cryptolithus* versus *Trinucleus* has been reviewed recently by Foerste,⁹ who comes to the only possible conclusion, which is, that the use of *Trinucleus* is unjustified. The present habit of dating *Trinucleus* back to Llhwydd (1698) can not be upheld, as he was a pre-Linnaean writer, and his use of *Trinucleum* was not at all in a modern generic sense. Murchison was the first describer of *Trinucleus*, which thus dates from 1839 (Silurian System). In 1832, two names were given to the trilobite which we usually call *Trinucleus*, *Cryptolithus* by Green in the monthly "American Journal of Geology and Natural Science," and *Nuttainia* by Eaton in the second edition of his text book. Both names appeared in the latter half of the same year, and it is not absolutely clear which appeared first. Dr. Foerste has stated the circumstances in detail, and shows that the evidence rather favours Green's name. Green certainly claimed priority, and we have no evidence that Eaton insisted that his name was published first. It is worthy of note that *Cryptolithus* was adopted by Bronn, Goldfuss, Emmrich, and Angelin, while Eaton's name was never again used by anyone for this genus.

In cases of priority, where the same species was not used as the type by both authors, it is of course necessary to proceed with caution, for further investigation may show that the two type-species really belong to different genera, as has proven the case with *Cheirurus* and *Ceraurus*, genera which have long been considered identical. In the present case the two types seem to be congeneric. Green's *Cryptolithus tessellatus* was founded on a specimen found in the shale at Waterford, New York. Murchison's first species was *Trinucleus caractaci*, which must be taken as the type of *Trinucleus*. Green's species differs from Murchison's in lacking the genal spines, and in having three instead of six rows of punctures on the border. The presence or absence of the genal spines is a condition of preservation, as the genal spines are on the free cheeks, and the number of rows of punctures varies within the limits of a single species, so it seems unlikely that these two species will ever require separate generic names.

The *Ogygia*, *Ogygites*, *Ogygiocaris* tangle is complicated but yields a satisfactory solution, as I have briefly shown recently.¹⁰ *Ogygia* was proposed by Brongniart,¹¹ who cited two species,

⁹ Bull. Denison Univ., p. 78, 1910.

¹⁰ Trans. Roy. Soc. Canada, ser. 3, vol. 5, sect. 4, p. 116, 1912.

¹¹ Histoire Naturelle des Crustacés Fossiles, p. 7, 1822.

Ogygia de Guettard and *O. de Desmarest*, which appear to be congeneric. The type of *O. guettardi*, which is still in the collections at the Sorbonne, in Paris, has recently been redescribed and figured by Ehlert in the first fasciculus of the *Paleontologia Universalis*. It is evident that this trilobite is not at all related to the familiar *Ogygias* of Wales and Scandinavia. Barrande was the first to point this out, and Tromelin and Lebesconte stated it long ago. These latter authors also noted that *Ogygia* was a preoccupied name, having been used by Hubner in 1816 for a genus of *Lepidoptera*, and they proposed *Ogygites* to replace it.¹² Goldfuss, in 1843, without giving any special reason, transferred Brongniart's *Asaphus de Buch* to the genus *Ogygia*, and this species has, in time, thanks to Salter's description, come to be considered the type of the genus *Ogygia*. Now that we know what the original type of that genus is, this later position can not be defended except on the general plea "That everyone knows what an *Ogygia* is, and it will make trouble to change now."¹³ *Ogygia buchi* was not one of the original species of *Ogygia*, is not generically the same as the species originally assigned to that genus, and yet is, by the law of tradition, made the type of *Ogygia*, thus ousting the original species! Truly scientists must venerate tradition! To be logical we must now propose a new generic name for the original species of *Ogygia*! But Sweden has produced a man who was not afraid to look things squarely in the face and defy tradition, and in his *Paleontologia Scandinavica*, Angelin proposed *Ogygiocaris* to replace *Ogygia* in the sense used by authors generally, but not by Brongniart, selecting the Scandinavian *O. dilatata* as the type. Therefore, *Ogygia* disappears, being preoccupied, *Ogygites* takes its place for primitive Asaphinæ with annulated pygidia and forked hypostomata, and *Ogygiocaris* stands for trilobites of the type of *Ogygiocaris dilatata* and *O. buchi*.

Another familiar name which must go, merely because it is preoccupied, is *Bronteus*. Goldfuss¹⁴ described this as *Brontes* in 1839. De Koninck¹⁵ saw that this name had already been used by Fabricius for an insect, and therefore proposed to change the name to *Goldius*, a contraction of *Goldfussius*. This did not appeal to Goldfuss, evidently, for he slightly modified his original term in 1843, making it *Bronteus*. If we can use a name only once in the animal kingdom, we must adopt *Goldius*. Here

¹² Assc. Fr. Avanc. Sci. Cong. Nantes, p. 631, 1876.

¹³ See Schmidt, Revis, Ostbali. Sil. Trilobiten, Abt. 5, lief. 3, p. 37.

¹⁴ Nov. Act. Acad. Cæs. Leop. Carol., vol. 19, pt. 1, 1839.

¹⁵ Nouv. Mem. de l'Acad. de Brux., vol. 14, p. 6, 1841.

again, the change in a generic name involves a change in the family name, and we have to use *Goldidæ* in place of *Bronteidæ*.

Reed¹⁶ has shown that the *Acaste* of Goldfuss¹⁷ was used by Leach in 1811 for a genus of Cirripedes, and he has proposed *Phacopidella* to take its place, with *Ph. glockeri*, Barrande as the type.

Arges, Goldfuss,¹⁸ was used by de Haan¹⁹ in 1835 for a sub-genus of Brachyura, and it has therefore been replaced by Gurich²⁰ with *Ceratarges*.

Arethusa was used by Barrande²¹ in 1846, but it had already been used in 1808 by Montfort (Conch. Syst.) for a mollusk. Corda therefore proposed *Aulacopleura* to replace the preoccupied name,²² and this name must be used in place of Barrande's later modification *Arethusina*.

To the names *Amphion*, *Harpina*, and *Platymetopus*, the writer called attention not long ago, and for them substituted *Pliomera*,²³ Angelin, and the new names *Eoharpes* and *Amphilichas*. *Pliomera* was at once accepted by Reed and by Schmidt, (Holm had previously called attention to the fact that this was the proper course, and Wiman had used *Pliomera*), *Amphilichas* has been used by Reed, and *Eoharpes* by Ruedemann, showing that the changes are readily adopted in certain quarters, at least.

LINCOLN'S SPARROW NESTING IN BRUCE COUNTY, ONTARIO.

During the nesting season of 1912, my friend, Mr. W. D. Hobson, Woodstock, was driving in the Bruce Peninsula, and when near Pike Bay, about twenty miles north-west of Wiarton, heard a very peculiar song. On looking up at the bird, he found it to be so much like a song sparrow that he accepted it as such, but on comparing notes with him as to the character of the song we both feel positive that the bird was a Lincoln's Sparrow, but as he was not acquainted with this species he did not recognize it.

The occurrence is worthy of record on account of the very scanty details of this bird nesting in Ontario, and this is the first

¹⁶ Geol. Mag. n. s. dec. 5, vol. 2, p. 173, 1905.

¹⁷ Opus cit. 1839.

¹⁸ Opus cit. p. 355, 1839.

¹⁹ Fauna Japan, vol. 5, p. 21, 1835.

²⁰ Neues Jahr. Beilage-Band 14, p. 531, 1901.

²¹ Not. prelim. Tril. Bohem., p. 48, 1846.

²² Prodrom einer Mon. etc., p. 84, 1847.

²³ American Jour. Sci., vol. 19, p. 377, 1905.

one reported south of the Georgian Bay, although in the east it is stated, in Macoun's "Birds of Canada," that several nests were found by the Rev. C. J. Young, in Leeds County, and one was shot by Mr. Spreadborough at Cache Lake, Algonquin Park, in July, 1910. These are the only records I can locate at present with regard to the nesting of this bird in the longitude of Ontario, which goes to show that our knowledge of the northern distribution of a few of our migrants is, as yet, very incomplete.

W. E. SAUNDERS.

ADDITIONS TO THE FLORA OF VANCOUVER ISLAND.*

By J. M. MACOUN, Assistant Naturalist,
Geological Survey of Canada.

For nearly twenty years after the publication of Part V of the Catalogue of Canadian Plants, in 1890, very little systematic botanical work was done on Vancouver Island, except in 1893 when Prof. John Macoun spent the collecting season there. Notes on the new species and additions to the flora of Vancouver Island made in that year were published in "Contributions from the Herbarium of the Geological Survey," printed in the *Canadian Record of Science* and *The Ottawa Naturalist*.

The need of a thorough study of the flora of Vancouver Island was so pressing that in 1908 Prof. John Macoun was instructed to undertake it, and that year he worked in the vicinity of Victoria and north to Nanaimo, and the following season, 1909, on the west coast, chiefly about Ucluelet. He was assisted both years by Mr. William Spreadborough, who had also collected at Nootka in 1906. Prof. Macoun, being otherwise employed in 1910 and 1911, Mr. Spreadborough continued the work of collecting in these years, spending part of the season of 1910 on Queen Charlotte Islands and part of 1911 in the interior of Vancouver Island. In 1912 both the writer and Prof. Macoun collected on Vancouver Island, the former on the islands in the Gulf of Georgia and in Strathcona Park, the latter chiefly in the vicinity of Sidney. The manuscript for a flora of Vancouver Island is now almost ready for the press, but so many additions to the known flora have been made in the years referred to and so many are now interested in the Vancouver Island flora that it seems advisable to publish for their information a preliminary list of the additions that have been made to the flora in recent years. Where not otherwise stated, all the

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citations refer to collections made by members of the Geological Survey staff, and the specimens are in our herbarium.

The list that follows is by no means complete and will be supplemented by the descriptions of new species.

1. *Asplenium viride*, Huds.
Ucluelet; Strathcona Park.
2. *Asplenium cyclosorum*, Ruprt.
Common; not separated from *A. Filix-foemina* in earlier publications.
3. *Polystichum munitum* var. *imbricatum* (D. C. Eaton) Maxon.
Mount Finlayson; Skirt Mountain.
4. *Polystichum Andersoni*, Hopkins. N. sp. in ed.
Strathcona Park. (W. B. Anderson).
5. *Polystichum oreopteris*, Swartz.
Shawnigan Lake. (J. R. Anderson).
6. *Woodwardia spinulosa*, Mart. and Gal.
Texada Island. (J. R. Anderson).
7. *Woodsia oregana*, D. C. Eaton.
Cowichan River, alt. 4,000 ft.
8. *Equisetum litorale*, Kuhlewein.
Shawnigan Lake.
9. *Lycopodium inundatum*, L.
Ucluelet.
10. *Selaginella Wallacei*, Hieron.
Common, recorded as *S. rupestris*.
11. *Selaginella densa*, Rydb.
Jansen's Island, Ucluelet.
12. *Selaginella selaginoides*, (L.) Link.
Ucluelet.
13. *Sparganium minimum*, Fries.
San Juan Lake. (Rosendahl).
15. *Potamogeton zosterifolius*, Schumacher.
Langford Lake.
16. *Scheuchzeria palustris* L.
Cowichan Lake.
17. *Panicum pacificum*, Hitchc. and Chase.
Renfrew district. (Rosendahl). Bear Lake; Strathcona Park.
18. *Hierochloa odorata*, (L.) Wahl.
Courtenay River near Comox.
19. *Alopecurus californicus*, Vasey.
Head of Ucluelet Inlet.
20. *Agrostis oregonensis*, Vasey.
Renfrew district. (Rosendahl). Rare at Ucluelet.

21. *Agrostis longiligula*, Hitchc.
Departure Bay; Bear Lake.
22. *Agrostis inflata*, Scribner.
Esquimaux.
23. *Agrostis aequivalvis*, Trin.
District of Renfrew. (Rosendahl).
Colquitz River; Ucluelet.
24. *Calamagrostis canadensis* var. *acuminata*, Vasey.
Comox; Departure Bay.
25. *Koeleria cristata*, (L.) Pers.
Burnside Road, Victoria; Bear Lake.
26. *Trisetum Nutkensis*, (Presl.) Scribn. and Merrill.
Renfrew district. (Rosendahl).
27. *Deschampsia cæspitosa*, Beauv.
Comox; Strathcona Park.
28. *Deschampsia atropurpurea* (Wahl.) Scheele.
Mount Benson; Strathcona Park.
29. *Avena fatua* var. *glabrata*, Peter.
Sooke; Victoria; Departure Bay.
30. *Beckmannia erucæformis*, (L.) Host.
Colquitz River.
31. *Distichlis spicata*, Beauv.
Ucluelet. Introduced from east with cranberry plants.
32. *Cynosurus echinatus*, L.
Oak Bay, Victoria; Nanaimo.
33. *Poa trivalis* L. var. *filiculmis*, Scribn.
Comox.
34. *Poa eminens*, Presl.
West shore, Vancouver Island. (J. R. Anderson).
Long Beach below Clayoquot.
35. *Festuca subulata*, Bong.
Bear Lake; Nanaimo.
36. *Festuca elatior*, L.
Comox.
37. *Bromus commutatus*, Schrad.
Victoria; Cowichan Lake.
38. *Bromus pacificus*, Shear.
Renfrew district. (Rosendahl).
39. *Bromus sterilis*, L.
Near Victoria.
40. *Bromus rubens*, L.
Nanaimo.
41. *Hordeum boreale*, Scribn.
Renfrew district. (Rosendahl).

- 42. *Elymus glaucus* var. *hirsutus*, M. O. Malte in ed.
Bear Lake, Cowichan Lake.
- 43. *Elymus glaucus* var. *robustus*, Davy.
Victoria; Ucluelet; Beacon Hill.
- 44. *Elymus borealis*, Scribn.
Renfrew district. (Rosendahl).
Ucluelet.

NOTE.—The names of many grasses have been changed since the publication of the Catalogue of Canadian Plants. The above are all additions.

- 45. *Scirpus riparius*, (R. Br.) Spreng.
Victoria; Comox; Departure Bay; Ucluelet.
- 46. *Scirpus validus*, Vahl.
Wellington; Sidney; Beaver Lake near Victoria.
- 47. *Carex scoparia*, Schk.
Ucluelet. Introduced with cranberry plants from the east.
- 48. *Carex pratensis*, Drej.
Victoria; Mount Benson; Departure Bay; Comox.
- 49. *Carex ænea*, Fernald.
Departure Bay.
- 50. *Carex stellulata* var. *cephalantha*, Bail.
Wellington; Ucluelet.
- 51. *Carex Deweyana*, Schwein.
Renfrew district; Victoria.
- 52. *Carex pseudo-Deweyana*, Kukenthal.
Comox.
- 53. *Carex globosa*, Boott.
Bear Lake, Cowichan.
- 54. *Carex limosa*, Linn.
Near Comox.
- 55. *Carex flexilis*, Rudge.
Ucluelet. Introduced from the east with cranberry plants.
- 56. *Carex aurea*, Nutt.
Cadboro Bay; Comox.
- 57. *Carex vesicaria* var. *major*, Boott.
Near Victoria; Wellington.
- 58. *Carex physocarpa*, Presl.
Kennedy Lake near Ucluelet.
- 59. *Carex Bonplandii*, Kunth.
Comox; Cedar Hill.
- 60. *Spirodela polyrhiza* (L.) Schleid.
Victoria.

61. *Juncus balticus*, Willd.
Renfrew district. (Rosendahl). Ucluelet; Departure Bay.
62. *Juncus effusus* var. *compactus* L. and C.
Ucluelet. Introduced with cranberry plants from the east.
63. *Juncus alpinus* var. *fuscescens*, Fernald.
Strathcona Park.
64. *Juncus orthophyllus*, Coville.
Koksalah River.
65. *Juncus effusus*, L. var. *bruneus*, Engelm.
Ucluelet; Departure Bay.
66. *Juncus effusus*, L. var. *pacificus*, F. and W.
Victoria; Nanaimo; Ucluelet.
67. *Juncus effusus* var. *gracilis*, Hooker.
Sidney.
68. *Juncus falcatus* var. *alascensis*, Coville.
Renfrew district. (Rosendahl). Kennedy Lake near Ucluelet; Strathcona Park.
69. *Juncus brevicaudatus*, (Engelm.) Fernald.
Ucluelet. Introduced with cranberry plants from the east.
70. *Juncus Mertensianus*, Bong.
Ucluelet; Strathcona Park.
71. *Luzula comosa*, E. Meyer.
Victoria. Only record for typical *L. comosa*.
72. *Erythronium Howellii*, Wats.?
Barklay Sound. (Hillier). Cowichan Lake. First collected by Anderson.
73. *Erythronium montanum*, Wats.?
Grand Central Lake. (Fraser).
74. *Lloydia serotina*, (L.) Swert.
Strathcona Park.
75. *Disporum Smithii*, (Hook.) Piper.
Gordon River. (Rosendahl). Cowichan Lake.
76. *Streptopus curvipes*, Vail.
Cowichan River; Strathcona Park.
77. *Clintonia uniflora*, Menzies.
Cowichan Lake; Strathcona Park.
78. *Iris versicolor*, L.
Ucluelet. Introduced with cranberry plants from the east.
79. *Sisyrinchium idahoense*, Bicknell.
Renfrew district. (Rosendahl). Victoria; Nanaimo; Shawnigan Lake; Ucluelet.

80. *Sisyrinchium littorale*, Greene.
Victoria; Ucluelet; Nootka.
81. *Sisyrinchium birameum*, Piper.
Ucluelet.
82. *Sisyrinchium Macounii*, Bicknell.
Comox; Nanaimo; Beaver Hill; Ucluelet.
83. *Listera caurina*, Piper.
Cameron Lake; Mount Benson; Ucluelet.
84. *Salix macrostachya*, Nutt.
Koksilah River.
85. *Salix* sp.
A common species around Victoria. Not yet described but heretofore referred to *S. cordata*.
86. *Comandra Richardsoniana*, Fernald.
Langford Plains near Goldstream.
87. *Rumex occidentalis*, S. Wats.
Esquimault; Sidney; Nanaimo; Ucluelet.
88. *Rumex conglomeratus*, Murr.
Departure Bay.
89. *Rumex salicifolius*, Weinm.
Nanaimo; Ucluelet; Cowichan Lake.
90. *Polygonum aviculare* var. *vegetum*, Ledeb.
Near Comox; Nanaimo.
91. *Polygonum Douglasii*, Greene.
Near Duncan's.
92. *Polygonum spergulariæforme*, Meisn.
Beacon Hill; Nanaimo; Cowichan River; Campbell River.
93. *Polygonum tomentosum*, Schrank.
Near Victoria.
94. *Polygonum amphibum* var. *Hartwrightii*, (Gray) Bissell.
Colquitz River.
95. *Polygonum hydropiperoides*, Michx.
Elk Lake near Victoria.
96. *Amaranthus græcizans*, L.
Departure Bay.
97. *Amaranthus blitoides*, Wats.
Departure Bay.
98. *Abronia umbellata*, Lam.
Pachene Bay. (Geo. Fraser).

MEETINGS OF THE BOTANICAL BRANCH.

Dec. 21st, 1912, at the home of Mr. Geo. H. Clark. The following gentlemen were present: Geo. H. Clark, R. B. Whyte, E. D. Eddy, J. W. Eastham, A. Eastham, H. A. Honeyman, C. J. Tulley, W. Dreher, A. E. Attwood, Dr. M. O. Malte, L. H. Newman, J. J. Carter and H. Groh.

The subject of the evening, which was presented by Dr. M. O. Malte, was as follows: "The nature study of plants in relation to their identification." The speaker showed by means of specimens, that certain plants vary in form to a remarkable extent under different conditions of life. Attention must therefore be paid when identifying plants to the conditions under which the plants are grown, otherwise certain modified specimens of a given species may be regarded as belonging to quite another species. The confusion which the young botanist meets with on account of variations in the post-floral development of certain species was also pointed out and illustrated by specimens of the Ground Cherry (*Physalis grandiflora*), Madwort (*Asperugo procumbens*), Bitter Dock (*Rumex obtusifolius*) and certain species of Rosaceae.

The difficulties associated with the identification of species of the genus *Salix*, (willows) due to variations which appear at different periods of their development were pointed out and illustrated. It was shown to be imperative that species of this genus be studied at different stages throughout the season. Without such a study the student could have little idea of the variations within the species.

From the discussion there emanated the conclusion that a collection of plants should not be restricted to *single individuals* within the species, but rather should include typical variations which arise at different stages of development or under different conditions of life. To get a clear idea of a given species, moreover, the plants must be studied in the field. The facilities for doing this, as provided by the excursions of the club during the spring and early summer, were referred to. The speaker believed, however, that plants should not be pulled, taken to the platform of a railway station—as is often the case—and then studied, but rather should the study be made of the undisturbed specimens in their natural habitat.

The new "Flora" which is being prepared of plants of the Ottawa Valley is likely to materially facilitate the proper study of plant life.

A general discussion followed the presentation of the above paper in which such interesting phenomena as the development

of awns in oats when grown under different conditions was discussed.

L. H. N.

January 4th, 1913, at the home of Mr. A. E. Attwood, Present, in addition to the host, Messrs. Buck, Brown, Malte, Whyte, J. M. Macoun, W. T. Macoun, Newman, Dreher, Blackader, Dymond, Tully and Honeyman. The subject for the evening was the Ecology of the Ottawa Flora, the discussion being opened by Mr. J. M. Macoun, who gave some interesting information. At the outset Mr. Macoun made the announcement that "The Flora of the Ottawa District," originally begun by the late Dr. James Fletcher and completed by Prof. John Macoun, so far as the names and localities were concerned, would soon be ready for publication. In addition to the list of plants there will be a key by which the species can be readily identified. This key, which has been prepared by Dr. Malte, assisted by Mr. Macoun, will apply only to the local flora, and in this respect will be different from all other keys which have been published, and on account of the relatively few plants on the list it should prove a very simple matter to identify a species.

Mr. Macoun said that while the definition of Ecology was sometimes given as "Plants in their Relation to Environment" the proper definition was "Adaptation of Plants to Their Environment."

Plants have been classified from an ecological standpoint according to their environment; such as, those growing entirely under water, those having only their leaves above water and through various other gradations until all the plant except the roots was out of water.

Another group are those plants which grow in very dry soils. In this group is included all those that grow on dry rock as distinguished from those growing in crevices or on loose soil over rock.

Another are those on very saline soil, of which we have none in this district.

The last group includes all plants which are moisture-loving (hygrophytes) during some favourable part of the year, and dry (xerophytes) during the rest of the year; as, deciduous trees and shrubs, deciduous herbaceous plants with underground perennating organs, and annuals. This group was first called mesophytes, but afterwards changed to tropophytes.

Mr. Macoun drew attention to the fact that in these groupings the great bulk of our Ottawa Flora is thrown into the last group. One member objected strongly to a classification which included deciduous trees and bulbous plants in the same group.

E. H. B.

THE MILKWEED AND INSECTS.

In connection with Mr. Sladen's note in the December number of THE NATURALIST telling of the bee with the pollinia of *Asclepia* attached to its feet, and describing the remarkable method of cross fertilization adopted by this plant, it may be of interest to remark that *Asclepia*'s device to ensure the effective dissemination of its pollen causes—in the case of our native *A. syriaca* at least—the death of large numbers of insects. The pollinia are so difficult, comparatively, to withdraw, that they can be removed from their cells only by strong insects like the larger species of bees. Less sturdy seekers after nectar which get their feet caught in the clips, as recounted by Mr. Sladen, are not able to pull out the pollen masses. Their struggles seem only to wedge their legs more firmly in the narrow fissures of the corolla, and unable to free themselves, these hapless guests at the Caesar Borgia feast spread by the plant, die a lingering death.

Many different kinds of insects, such as flies, beetles, gnats, wasps, bees, and small butterflies and moths, come thus to an untimely end, but in my experience, by far the most frequent victims are ants. An examination of the blossoms of *A. syriaca* growing in the vicinity of ant colonies never fails to discover some of these exemplars of Solomon caught fast in the manner described, some still vainly struggling for freedom, others hanging dead like gibbeted malefactors.

This destruction of insect life is apparently merely accidental, and seems to be of no particular use to the plant. For, of course, *Asclepia* is entirely devoid of any such digestive apparatus as is found in the sundews and pitcher plants, and cannot utilize the dead insects in any way as food. Doubtless, cross fertilization is much better accomplished by the stronger flying insects, which are capable of carrying the pollinia farther and safer than the weaker flyers or the crawlers, but death seems a rather severe discipline of the latter for their undesired visit.

CHARLES MACNAMARA, Arnprior, Ont.

BOOK NOTICES.

HARDY ROSES: THEIR CULTURE IN CANADA, by W. T. Macoun, Dominion Horticulturist; Pamphlet, No. 9, Dominion Experimental Farms.

Lovers of flowers will welcome the appearance of this pamphlet of 12 pages, which may be obtained free of charge

from the author, Central Experimental Farm, Ottawa. The titles of the paragraphs will give an idea of the scope of the publication, viz.: "Site and Soil"; "Plants and Planting"; "Cultivation and Watering"; "Manuring"; "Pruning"; "Winter Protection"; "Insects and Fungous Enemies and How to Treat Them," and pages 7 to 12 are occupied in listing the "Best Varieties of Roses." Ottawa growers will find the information on pages 11 and 12 of much value as we have here reliable data on the successful growing of many choice varieties at Ottawa. During the past 21 years very many varieties have been tested on the Central Experimental Farm.

A. G.

CORRESPONDENCE.

The Editor, OTTAWA NATURALIST:

Many of your readers know of the bird nesting boxes made in Germany after the pattern of Baron von Berlepsch, and some would doubtless like to get them, if available at a reasonable figure, but importation from Europe is of course expensive. To meet this need I have just brought out a few dozen assorted sizes and will turn these over to any nature lover at actual cost as long as they last. The sizes are:

A1. For Wrens.

A. Tree Swallows and Wrens, etc.

B. Blue Bird, Crested Fly Catcher.

C. Flicker.

D. Screech Owl, Sparrow Hawk, Flicker.

The first two sizes cost 40c., B. 50c.,
and C. and D. \$1.15.

The packing in London will cost 15c. for one and 5c. for each additional one. Remittances should, of course, be made with the order. It is quite probable that several Ottawa people would want to buy these, and it might be advisable to have the orders collected by your secretary and shipped in one lot, which would economize in packing and freight. The boxes are not here at this writing, but are expected by February 15th, and it would be well to have them in advance so that they may be put in place by the time the birds arrive.

In 1912 the first Flicker I saw was the one in the nesting box within twenty feet of my bedside, where they nested last year, which goes to show that they do not waste any time in looking over the ground.

W. E. SAUNDERS.

London, Ont., January 31st, 1913.

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SOME CONDITIONS OF PROGRESS IN THE PLANT WORLD.*

By W. T. MACCLEMENT, D.Sc., Professor of
Botany, Queen's University.

There is no unanimity as to the meaning of the term *progress*, but I shall use it in the ordinary sense of change, from simplicity of structure to complexity, that is from uniformity of parts to specialization of parts, from every part doing all kinds of work to complete division of labor.

I shall ask you to imagine first a lifeless world in which the only changes were physical and chemical. Condensation, solution, diffusion, combinations, and decompositions all went on vigorously in warm moist surroundings. This may have gone on for ages, but finally, in all probability, as the climax of a long series of combinations and rearrangements, some of these chemical changes resulted in the formation of an unstable, gelatinous substance which we call *Protoplasm*. In spite of much serious study and long continued experimentation man has not yet quite mastered the chemical processes involved in the building up of protoplasm. We know that it is made of carbon, hydrogen, oxygen, nitrogen, phosphorus and sulphur—"the dust of the earth"—and that it is probably a water solution of proteids. Well, this translucent semifluid substance protoplasm was siezed upon by a new force which gave the protoplasm qualities in which it differed in a marked way from any other chemical compound. One of these qualities is the ability of protoplasm to change many other substances into its own substance, thus increasing the quantity of protoplasm. This ability is not possessed by any other kind of matter known to man. We call this new force *Life*, and one of the notable powers of Life is this,—of giving to protoplasm the power to assimilate food, to grow thereby and also to divide itself into two or even many parts, each of which retains all the distinguishing qualities of the parent mass.

*Lecture given before the Ottawa Field-Naturalists' Club, Feb. 25th, 1913.

Unless we are advanced students of psychical research we will agree that the force called life manifests itself *only* through the medium of *matter*. Protoplasm has the distinction of being the *only kind of matter*, in which *life makes itself evident*. We cannot avoid desiring to know what is the real nature of this vital force, and what is its origin. These questions are yet to be answered to the satisfaction of all. Those who desire to reduce all phenomena to known chemical and physical changes, reason as follows:—Life is made evident by the production of energy. Energy is obtained from matter by chemical changes in the matter—for example, we thus get heat, electricity, explosions, etc. The greatest and most continuous manifestations of energy come from the substances which are the least stable. Such substances as protoplasm are notably unstable, and chemical changes accompanied by energy changes are constantly going on in protoplasm. *Life is the summation or resultant of all these changes*. But can this be true? We may easily so act upon protoplasm that the life in it is destroyed, and yet it is protoplasm, and chemical changes go on rapidly in it. But these changes do not constitute life. They soon result in the destruction of the protoplasm. It therefore seems that the relation of life to chemical changes in protoplasm is rather a directive one—life being a power capable of controlling and deciding the kinds of chemical change which may occur in protoplasm. Huxley clearly set forth the difference between living and non-living matter in his famous definition—"Living matter is distinguished by its continual disintegration by oxidation, and its concomitant reintegration by the intussusception of new matter." Just so! Non-living protoplasm is also continually "disintegrated by oxidation," but there is no "concomitant intussusception of new matter." And so the dead protoplasm is gradually consumed. An alternative explanation of the origin of life is that it was "breathed into" protoplasm from some Source of Life outside the protoplasm. This statement, although apparently not scientific, has the advantage of being more difficult to disprove chemically, than any of the chemical explanations at present offered.

Whatever may have been the origin of protoplasm or of the life force within it giving it sensation, mobility, power of growth and of reproduction,—there can be no doubt of the present existence of minute masses of protoplasm having these properties. The conditions in which this first protoplasm lived were probably warmth, moisture and possibly light. Only in the presence of some moisture, and a moderate temperature will life continue active in protoplasm. The source of heat in the primitive world was probably the cooling crust of the earth, but eventually light

penetrated the atmosphere and reached the living protoplasm. The simplest masses of protoplasm we are able to study are minute spherical or elongated structures, with a firm boundary or wall, or with a gelatinous envelope. These have two methods of reproducing themselves, the simplest of which is by each merely splitting into two—fission. The other method consists in the material which forms one mass breaking into many small parts within the wall. These parts escape through a rupturing of the wall of the parent cell. Each of these new individuals seems to be exactly like all the others, and is independent of all the others, doing for itself whatever is necessary for its life.

In examining the various one celled plants we are struck by the fact that one great group of them has kept the habit of living each by itself, a distinct individual life, while those of the other group adhere to each other in irregular masses, or even form carefully arranged colonies. We note that most of those that retain their independence live in dark, moist, warm situations, often within larger living creatures, and they accentuate their individual liberty by moving from place to place, through short distances. We call them Bacteria. They never reach any considerable size nor permanence of structure, but being bathed constantly in liquids which yield them nourishment, they increase rapidly in numbers by the process of cleavage, each splitting into two, and these again in a very short time. By this geometric progression they multiply at a prodigious rate, and we are aware that their activity or the poisonous substances they excrete are a menace to the lives of many of the higher creatures which they inhabit. Fortunately for us they have not learned how to protect themselves against light, which when intense exerts a destructive influence on colorless protoplasm. Another weakness of bacteria, and the same is true of nearly all other kinds of fungi, is that each individual is literally "a chip of the old block." The parent really becomes rejuvenated in the form of two offspring made from its material. Let me ask you to note that this is a form of immortality. Here there is no such thing as maturity, old age, and death. Each bacterium literally "renews its youth" by making of itself two new bacteria. Each of these must therefore retain unchanged the qualities of the only parent it has. There is little chance of its receiving any influence which will cause variation, and each is exactly of the character of the line of parents preceding it. Its qualities are rigidly fixed in the type of its ancestors. In this fixity of type and lack of adaptability of the race of fungi we have an important character which aids us when we desire to prevent their growth. If we can modify in any marked degree the conditions surrounding them, we render their existence difficult, if not impossible. An illustra-

tion of this is the fact that of all the edible, fleshy fungi known and desired by man, we have learned the conditions of growth of only one, the common Meadow Mushroom, and in spite of many long continued efforts at cultivation by botanists and epicures, not another kind has as yet been tamed.

The fungi "seek darkness rather than light" and usually the only parts which come into the light are those reproductive structures which quickly break down into minute fragments to be scattered by the wind and water. These colorless plants are able to live only by absorbing other protoplasmic substances, either dead or alive. They are therefore not honest in getting their livelihood, but take it from others, although it is true that in some instances they give valuable service in exchange.

Note that in the forms of life thus far mentioned there is no such phenomenon as sex. But when we turn to those which have learned to tolerate light and protect themselves from its harmful power, we at once come into contact with another method of reproduction, and this method has proved so advantageous that all but the lowliest forms of life have adopted it. Sexual reproduction differs from that described as belonging to most fungi, in that each offspring has two parents instead of one. In place of fragments—(spores) falling from one individual, and each spore growing into an individual like the parent—two fragments are necessary, usually one from each of two different individuals, these spores fuse together into one, and this resulting egg has the power of growing into an individual like the parents.

Such an arrangement is evidently much less simple than the other, the sexual way, but, as said before, it has become the method among all higher organisms. There must be very important advantages connected with it. We are not able to give clear and complete reasons for the general adoption of the sexual method, but one advantage has been indicated by contrast. In sexual reproduction—say in *Spirogyra*, one of these simple plants—fragments of two individuals take part in the formation of each new *Spirogyra* individual. The parent filaments of *Spirogyra* being free floating plants, did not grow under exactly similar conditions and are not likely to be offspring of the same two parents. Hence they will have qualities which are somewhat unlike. This variety of qualities will be inherited by their offspring, and the offspring will thereby have more power of adapting itself than though derived from a single parent having but one set of qualities. As the young *Spirogyras* float about they will certainly have a better power of adapting themselves to the variety of conditions they will meet, than has the young fungus, which has no varied assortment of qualities, derived from a varied assortment of ancestors. It is certain this is an

important advantage, but probably there are many others yet to be learned. But mark, that by acquiring adaptability, Protoplasm has secured the power to live under all sorts of conditions, and this is no small advantage.

Let us now turn to the ability of many plants to live in the light. They must in some way prevent the actinic rays from penetrating them through and through. We find that protoplasm has responded to the danger of destruction by light, by the extremely wise method of changing a deadly enemy into a friend and even into a valuable servant. The change, however, is not in the light, but in the protoplasm. In a part of its own substance it develops a green coloring matter—chlorophyll—which it places near the surface, and this absorbs the energy of the light, preventing its destroying the inner protoplasm, and also enabling it, through the energy thus captured, to accomplish some most astounding chemical changes. There are certain substances so stable that when man in his chemical operations forms these substances, he lets them go as waste products. Among these are prominently carbon dioxide and water. The energy required to decompose these substances is so great that under no ordinary conditions of manufacture can we undertake it. But protoplasm, with the energy absorbed from sunlight, quietly takes apart these refractory materials, and builds up their separated elements into such complex substances as starch, fats, and proteids, and as if in derision of man's efforts, gives these to man to be his foods. Man, if properly informed, reverently accepts them, confessing his ignorance and inability to make them for himself. It is suggested—in view of this power of green protoplasm, that greenness is an important stage or condition of progress. Plants lacking greenness have to live as man and the other animals do, on the products of the energy and ability of the green plants. It is because of this power of green plants to manufacture an abundance of food for themselves that large and enduring plant structures and all kinds of animal life become possible. The protoplasm of which we are made, develops in our surface layers when exposed to light, a protective pigment, usually not green, but brown or black. The presence of this permits of human life in intensely lighted regions. Those who do not develop it readily, retreat from the tropics or die.

Having marked the victory of protoplasm over one enemy we may proceed to see how it meets another. We have seen that the presence of warmth and moisture are the prime conditions essential to the life of protoplasm. It should now be noted that these are incompatible conditions, inasmuch as warmth implies the evaporation of moisture, and on the other hand the high specific heat of water keeps at a comparatively low temperature

any large body of water. In other words, much heat drives away water, and much water prevents warmth. To have plenty of moisture a plant must be surrounded by water. To have plenty of light and heat it must be out of water. How can these contradictory needs be properly met?

Simple green plants of only one or a few cells might float on the surface of a body of water, enjoying plenty of light and water, but the temperature would be lower than that which is most stimulating to their life-processes. If they drift ashore the heat of the sun will soon remove the water necessary to their life, in spite of the wall of cellulose they construct about themselves. Some new arrangement is necessary. Protoplasm responds to this challenge by keeping the offspring close together, until a mass is formed. The inner ones are kept from the drying air by the outer ones, which are soon destroyed, becoming empty cells, but forming a more or less waterproof and non-conducting coating. This method is another permanent victory over threatening conditions because we find that every kind of creature living in air has adopted this plan of an *epidermis*.

But in this mass of cells, each one demands an equality in exposure to light, warmth and moisture if all have the same work to do, so we find that they have gradually adopted some definite arrangement, regular and symmetrical. It is quite evident that if every cell is to be independent of every other cell, it must be equally exposed to beneficial conditions. This perfect socialistic condition is consummated in *Volvox*—a symmetrical sphere which rotates slowly in the water. It is evident that a small sphere is the climax in this direction, as in a larger one the inner cells would be beyond the reach of light, and possibly of moisture, and even such a sphere must remain in water in order to rotate.

There seems no further progress possible in the face of these opposing conditions. How can anything better be produced? Here Protoplasm had to strike out a new line of progress. We describe it briefly as Division of Labor. The first evidence we have of this is in such small plants as *Riccia*, floating on still water or living on damp soil. Their mass of cells may be compared to the spherical *Volvox*, but instead of rotating and exposing every surface to light, one side of *Riccia* is permanently set aside to absorb light and air, while the other is devoted to the absorption of water. This division of labor may seem a small advance, but it contains a prophecy of everything we find in the structure of the tallest tree.

The dorsiventral arrangement proved itself a success, and larger land plants of similar arrangement and structure were produced, with an elaborate epidermis and ventilating system.

These were merely flat masses of cells, spread on moist soil. Now came another ministry of progress. Neighboring plants occupying the surrounding territory grow over a flat mass and cut off its supply of light. Protoplasm responds to this danger by breaking the flat expanse into irregular parts attached to a central axis, and this axis soon rises slightly from the soil. This is the condition we find in the mosses. But another danger is at once encountered. Such elevated parts are removed from the necessary water supply, although favorably placed for light and air.

So if elevation of parts is necessary there must be devised a conducting system, and a strengthening system also, to enable the erect plant to resist wind currents. Protoplasm recognizes and meets this difficulty. Among the mosses we find a suggestion of a stem—the green surface is divided into somewhat regular little leaflike parts, and these are placed radially on a short, central axis, which is strong enough to hold them erect a fraction of an inch. But no true conducting structures are met in plants lower than the ferns. There we find that ordinary short roundish cells become immensely elongated, and their side walls strengthened. The presence of these tubes, which permit a ready passage of liquid from the soil to the uppermost parts, makes possible what we have in our most complex groups of plants—roots for absorption deep in the soil, stems and leaves reaching many yards above the soil. These tubes must be held erect against gravity and the destructive rush of the wind. So wood is developed—a mass of cells part of which are modified into tubes and another part into fibres—slender, strong and elastic.

Let us now glance back for a moment and notice that somewhere in the advance from simplicity, there enters the phenomenon of Death, as we think of it. We saw that the simplest organisms cannot be said to die, inasmuch as the living parent is merged in the offspring of which it forms so considerable a part.

But apparently as an associated condition with the evolution of sex came the need of a certain maturity of parent, and the germ cells became at length not the whole of the parent but only a small proportion of its mass. Then we find that the mature plant produces germ cells only once, or a limited number of times, and after such definite effort at reproduction, the parent dies, except as represented by its offspring, to which it has contributed a minute portion. This small contribution from the parent carries with it a wonderful power of heredity, but not sufficient to prevent variation, or to enable us to say that the individuality of the offspring is lost.

The fact of variation is undeniable, we may find examples in every family, and in the leaves of every tree. The possibility of

variation must be acknowledged. But notice that an outside force such as heat or light can do no more than act as a stimulus. The Protoplasm, so far as we can see, might have lived along the line of least resistance, flourished where conditions were entirely favorable, and died out wherever light, heat, etc., became too great. But life has spread from quiet waters to cover the face of the earth, adapting itself by increasing complexity to every variety of condition found on a globe which is far from monotonous in surface. I believe that it does so because Progress is a law of Life. By that I mean that the Creator of Life has stamped His design on living matter, so that it does not yield to difficulties, but matches itself against threatening conditions and makes them servants—steppingstones. This belief makes a chemical origin of life unthinkable, as no known series of chemical changes holds within it the necessity of progress. We recognize that in mental and moral life we cannot stand still, we either advance or retrograde. But just so surely as progress is an inseparable condition to success in living, so a perpetual struggle with the environment of life seems an inseparable condition for progress. This in the world of matter is doubtless what the poet implies as ruling in the world of spirit—"Wher'ere the prizes go, grant me the struggle that my soul may grow."

ADDITIONS TO THE FLORA OF VANCOUVER ISLAND.

By J. M. MACOUN, Assistant Naturalist,
Geological Survey of Canada.

(Continued from page 149).

99. *Claytonia Chamissoi*, Ledeb.
Comox.
100. *Portulaca oleracea*, L.
Cowichan Station.
101. *Dianthus Armeria*, L.
Vicinity of Victoria.
102. *Silene Armeria*, L.
Raymond's Crossing.
103. *Lychnis coronaria*, (L.) Desv.
Nanaimo.
104. *Agrostemma Githago*, L.
Cowichan River (Clendenning); Victoria.
105. *Cerastium campestre*, Greene.
Most of the references to *C. arvense* in previous publications are this species.

106. *Cerastium graminifolium*, Rydb.
Cadboro Bay and Xmas Hill, Victoria; Cowichan Lake.
107. *Stellaria longifolia*, Muhl.
Newcastle Island, Departure Bay.
108. *Stellaria humifusa*, Rottb.
Newcastle Island; Ucluelet.
109. *Stellaria strictiflora*, (Rydb.)
Beaver Lake.
110. *Sagina stricta* var. *maritima*, Fries.
Langford Lake.
111. *Spergula sativa*, Boenn.
Common. Listed as *S. arcensis*.
112. *Spergularia salina* var. *leiosperma*, Kindb.
Sidney.
113. *Clematis ligusticifolia*, Nutt.
Running wild at Departure Bay.
114. *Anemone Hudsoniana*, (DC.) Richard.
Koksilah. First collected there by Mr. J. R. Anderson.
115. *Thalictrum occidentale*, Gray.
Cowichan Lake. (Glendenning; Anderson; Macoun)
Koksilah River.
116. *Batrachium Lobbii*, A. Gray.
Lost Lake.
117. *Ranunculus flammula* var. *reptans* (L.) Schlecht.
Nanaimo. (Fletcher and Anderson) Shawnigan Lake;
Cowichan River; Ucluelet; Strathcona Park.
118. *Ranunculus Eschscholtzii*, Schlecht.
Mount Arrowsmith. (J. R. Anderson). North of
Cowichan Lake; Strathcona Park.
119. *Ranunculus pennsylvanicus*, L.
Ucluelet.
120. *Ranunculus acris*, L.
Sparingly naturalized.
121. *Ranunculus platyphyllus*, (Gray) Piper.
Comox; Cadboro Bay; Cowichan Lake.
122. *Caltha asarifolia*, DC.
Comox.
123. *Trollius laxus*, Salisb.
North of Cowichan Lake; Strathcona Park.
124. *Coptis asplenifolia*, Salisb.
Renfrew district. (Rosendahl). Cumberland (W. B.
Anderson); Comox; Ucluelet.
125. *Eschscholtzia californica*, Greene.
Beacon Hill.

126. *Eschscholtzia recta*, Greene.
Cameron Lake.
127. *Draba verna*, L.
Cadboro Bay.
128. *Lobularia maritima*, Desv.
Victoria.
129. *Dentaria geminata*, Wats.
Koksilah River. (R. H. Jameson).
130. *Dentaria macrocarpa*, Nutt.
Burnside Road near Victoria.
131. *Cardamine occidentalis*, S. Wats.
Kennedy Lake near Ucluelet.
132. *Cardamine intermedia*, Holm.
Victoria; Wellington; Nanaimo; Ucluelet.
133. *Cardamine kamschatika*, (Regel) Schultz.
Victoria.
134. *Arabis glabra* (L.) Benth.
Cowichan River (Glendenning); Esquimault; Nanaimo; Ucluelet; Strathcona Park.
135. *Arabis lyrata* var. *occidentalis*, S. Wats.
Cowichan Lake.
136. *Arabis Drummondii*, Hook.
North of Cowichan Lake, alt. 4,000 ft.
137. *Arabis Hookeri*, Lange.
Cowichan Lake.
138. *Radicula indica* (L.)
Nanaimo.
139. *Radicula Nuttallii*, Rydb.
Beaver Lake; Lost Lake.
140. *Barbarea americana*, Rydb.
Cowichan River. Other V. I. specimens are *B. vulgaris*.
141. *Erysimum elatum*, Nutt.
Mount Arrowsmith; Cameron Lake. (J. R. Anderson). Strathcona Park.
142. *Brassica occidentalis*, Rydb.
Victoria.
143. *Sisymbrium altissimum*, L.
Victoria; Nanaimo.
144. *Hutchinsia procumbens* (L.) DC.
Beacon Hill.
145. *Lepidium densiflorum*, Schw.
Nanaimo.
146. *Lepidium strictum*, Ruttan.
Cadboro Bay.

147. *Lepidium Draba*, L.
Victoria. (J. R. Anderson).
148. *Senebiera didyma*, Pers.
Victoria; Nanaimo.
149. *Cakile edentula*, (Bigel.) Hook.
Long Beach above Ucluelet.
150. *Sedum divergens*, S. Wats.
Mount Benson.
151. *Rhodiola alascana*, Rose.
Chatla Village, west coast.
152. *Boykinia vancouverense*, Rydb.
Goldstream; Ucluelet.
153. *Boykinia cinnatum*, Rosendahl and Rydb.
Cowichan River. *B. elata* is not rare.
154. *Leptarrhena amplexifolia* (Stenb.) Ser.
North of Cowichan Lake; Strathcona Park.
155. *Saxifraga Tolmiei*, T. & G.
Lady Mountain. (J. R. Anderson). Strathcona
Park.
156. *Saxifraga rufidula*, Small.
Type collected on Mount Finlayson. Parson's
Mountain; Mount Malahat; Cowichan Lake; Mount
Arrowsmith.
157. *Saxifraga bidens*, Small.
Cowichan Lake. (Glendenning). Type collected,
Cedar Hill. Not rare around Victoria.
158. *Saxifraga odontophylla*, Piper.
Mount Arrowsmith.
159. *Tiarella unifoliata*, Hook.
Departure Bay; Ucluelet.
160. *Mitella Breweri*, Wats.
Mts. north of Cowichan Lake.
161. *Leptaxis Menziesii* (Pursh.) Raf.
Renfrew district (Rosendahl). Common in the
Cowichan valley.
162. *Ribes laxifolium*, Pursh.
Barkley Sound; Ucluelet.
163. *Spiræa salicifolia*, L.
Ucluelet. Introduced with cranberry plants from
the east.
164. *Rubus nivalis*, Dougl.
Comox. (W. B. Anderson). Beaufort Range.
(J. R. Anderson). Strathcona Park.
165. *Rosa nutkana* var. *hispida*, Fernald.
Colquitz River.

166. *Potentilla monspeliensis*, L.
Wellington; Ucluelet.
167. *Potentilla gracilis*, Dougl.
Not uncommon around Victoria.
168. *Potentilla nivea*, L.
Mount Arrowsmith. (Anderson and Fletcher).
- NOTE.—Many species of *Potentilla* and *Fragaria* have been separated from those recorded in previous lists, too many for citation.
169. *Sibbaldia procumbens*, L.
Mts. north of Cowichan Lake; Strathcona Park.
170. *Geum oregonense*, Scheutze.
Not rare; confounded with *G. macrophyllum*.
- 171-2. *Amelanchier florida* Lindl. and *A. Cusickii* are both common. Referred usually to *A. alnifolia*.
173. *Pyrus occidentalis*, Greene.
Mts. north of Cowichan Lake; Strathcona Park.
174. *Pyrus sitchensis*, (Roem.) Piper.
Mount Prevost. (J. R. Anderson). Strathcona Park.
175. *Lupinus littoralis*, Dougl.
Comox; Nanaimo.
- NOTE.—Several species of *Trifolium* have been separated from those recorded.
176. *Vicia lathyroides*, L.
Langford Plains.
177. *Lathyrus littoralis*, (Nutt.) Endl.
Ahousett. (J. R. Anderson). Ucluelet.
178. *Lathyrus pauciflorus*, Fernald.
Esquimault; Sidney; Departure Bay.
179. *Geranium Bicknellii*, Britton.
Wellington.
180. *Callitriche Bolanderi*, Hegelm.
Victoria; Elk Lake; Cowichan Lake; Ucluelet.
181. *Empetrum nigrum*, L.
Mount Whymper; Ucluelet; Strathcona Park.
182. *Rhus diversiloba*, Torr. & Gr.
Saanich Arm. (J. R. Anderson).
183. *Pachystima macrophyllum*, Farr.
Apparently the commoner species on Vancouver Island.
184. *Malva neglecta*, Wallr.
Beacon Hill.
185. *Hypericum perforatum*, L.
Koksilah.

186. *Elodea campanulata*, Pursh.
Ucluelet. Introduced from the east with cranberry plants.
187. *Viola ophioides*, Greene.
Victoria; Shawnigan Lake.
188. *Viola fulcrata*, Greene.
Cowichan River. (J. R. Anderson).
189. *Viola compacta*, Greene.
Shawnigan Lake; Brehm Lake. (J. R. Anderson).
Several species of violets are yet to be described.
190. *Epilobium latifolium*, L.
Renfrew district. (Rosendahl).
191. *Epilobium adenocaulon* var. *occidentale*, Trelease.
Common.
192. *Epilobium alpinum*, L.
Mts. north of Cowichan Lake; Strathcona Park.
193. *Epilobium luteum*, Pursh.
Between Buttle's Lake and Grand Central Lake.
(Mr. Wood, M.P.)
194. *Circæa pacifica*, Aschers & Magnus.
Departure Bay; Cowichan Lake; Strathcona Park.
195. *Hippuris montana*, Ledeb.
Strathcona Park.
196. *Sanicula tripartita*, Suksdorf.
Victoria Arm.
197. *Caucalis microcarpa*, Hook. & Arn.
Departure Bay.
198. *Osmorhiza Liebergi*, Coult. & Rose.
More common than *O. divaricata*.
199. *Pyrola elliptica*, Nutt.
Cowichan Lake.
200. *Arctostaphylos media*, Greene.
Nanaimo River. (J. R. Anderson). A hybrid between *A. tomentosa* and *A. Uva-ursi*.
201. *Vaccinium Vitis-Idæa*, L.
Ucluelet.
202. *Vaccinium ovalifolium* x *parvifolium*.
A hybrid between these species was found in several places in Strathcona Park.
203. *Dodecatheon* sp.
Two of the species of *Dodecatheon* growing on Vancouver Island are well known, a third found at Nootka and Ucluelet has not yet been described.
204. *Lysimachia terrestris* (L.) BSP.
Ucluelet. Introduced with cranberry plants from the east.

205. *Gentiana Douglasiana*, Bong.
Renfrew district. (Rosendahl). Ucluelet.
206. *Menyanthes crista-galli*, Menzies.
Renfrew district. (Rosendahl).
207. *Menyanthes trifoliata*, L.
Common.
208. *Gilia intertexta*, Steud.
Near Victoria.
209. *Nemophila parviflora*, Dougl.
Near Victoria; Cowichan Lake. Earlier records of
N. parviflora are *N. pustulata* or *N. sepulata*, both of
which are common around Victoria.
210. *Phacelia heterophylla*, Pursh.
Cottonwood Creek, Cowichan Lake.
211. *Romanzoffia unalaschensis*, Cham.
Barkley Sound; Ucluelet; Cottonwood Creek,
Cowichan Lake. *R. sitchensis* has been collected in
several localities.
212. *Myosotis laxa*, Lehm.
Cowichan valley. (Glendenning). Elk Lake near
Victoria; Departure Bay.
213. *Allocarya phlebeia*, Greene.
Not rare near Victoria.
214. *Mentha arvensis* (L.) var. *lanata*, Piper.
Colquitz River; Elk Lake; Wellington.
215. *Collinsia tenella*, (Pursh.)
Not rare.
216. *Chelone nemorosa*, Dougl.
Renfrew district. (Rosendahl).
217. *Mimulus Langsdorfii* var. *platyphyllus*, Greene.
Nootka: Ucluelet.
218. *Mimulus pilosus* (Benth.) S. Wats.
Swan Lake.
219. *Gratiola virginiana*, L.
Near Victoria; Comox.
220. *Veronica alpina*, L.
Mts. north of Cowichan Lake; Strathcona Park.
221. *Castilleja angustifolia*, (Nutt.) G. Don.
Cowichan Lake.
222. *Castilleja rexifolia*, Rydb.
Cottonwood Creek, Cowichan Lake.
C. miniata, *C. levisecta* and *C. angustifolia* var.
Braulburii are common and at least two other species
remain to be described.
223. *Orthocarpus* sp.
Oak Bay; Fowl Bay; Sidney.

224. *Pedicularis* sp.
An undescribed species collected in Strathcona Park,
1912.
225. *Utricularia occidentalis*, A. Gray.
Ucluelet. New to Canada.
226. *Utricularia intermedia*, Hayne.
Ucluelet.
227. *Plantago macrocarpa*, Cham. & Schl.
Ucluelet.
228. *Galium kamtschaticum* var. *oreganum*, (Britton).
Bear Lake, Cowichan Lake.
229. *Galium trifidum* var. *subbiflorum*, Wiegand.
Colquitz; Wellington; Ucluelet.
The var. *pacificum* is not rare.
230. *Viburnum pauciflorum*, Pylaie.
Comox; Cowichan Lake; Strathcona Park.
231. *Echinocystis oregana*, Torr. & Gray.
Saanich. (J. R. Anderson).
232. *Heterocodon rariflorum*, Nutt.
Victoria.
233. *Solidago canadensis*, L.
Chemainus.
234. *Solidago lanceolata*, L.
Ucluelet. Introduced with cranberry plants from
the east.
235. *Solidago glutinosa*, Nutt.
Mount Benson. (J. R. Anderson; Macoun).
236. *Aster occidentalis* var. *intermedius*, Gray.
Elk Lake.
237. *Aster Cusickii*, Gray.
Victoria.
238. *Aster Eatoni* (Gray) Howell.
Elk Lake.
239. *Aster microlonchus*, Greene.
Fowl Bay, Victoria.
240. *Aster* sp.
An undescribed species collected in Strathcona Park,
1912.
241. *Erigeron* sp.
An undescribed species collected in Strathcona Park,
1912.
242. *Anaphalis margaritacea* var. *subalpina*, Rydb.
Elk Lake.
243. *Anaphalis margaritacea* var. *occidentalis*, Greene.
Not rare but not so common as typical *A. margaritacea*.

244. *Gnaphalium uliginosum*, L.
Elk Lake.
245. *Antennaria erigeroides*, Greene.
Mount Benson.
246. *Antennaria eximia*, Greene.
Mount Benson.
247. *Antennaria chlorantha*, Greene.
Mount Benson; Cowichan Lake; Strathcona Park.
248. *Antennaria* sp.
An undescribed species collected in Strathcona Park.
249. *Franseria cuneifolia*, Nutt.
Ucluelet.
250. *Madia sativa*, Molina.
Victoria.
251. *Rudbeckia hirta*, L.
Cowichan valley. (Glendenning).
252. *Erigeron canadense*, L.
Cowichan valley. (Glendenning). Sidney.
253. *Achillæa borealis*, Bong.
Ucluelet.
254. *Tanacetum huronense*, Hook.
Renfrew district. (Rosendahl). Clayoquot;
Ucluelet.
255. *Artemisia gnaphalodes*, Nutt.
Departure Bay.
256. *Senecio fastigiatus* var. *Macounii* (Greene) Greenman.
Langford Plains; Mount Benson; Wellington.
257. *Senecio* sp.
An undescribed species collected in Strathcona Park.

As was said in the introductory sentences, the above list of additions to the species recorded from Vancouver Island is by no means complete. Some common species and many introduced species have been omitted for want of space. Neither does the available space permit of the inclusion of synonymy. A few species have been included which were recorded in publications that are not accessible to the average collector. There are in the herbarium of the Geological Survey many sheets of specimens from Vancouver Island which have not yet been determined or of which the determinations are doubtful. These, when correctly named, will, with the introduced plants, add at least a hundred species to the above list.

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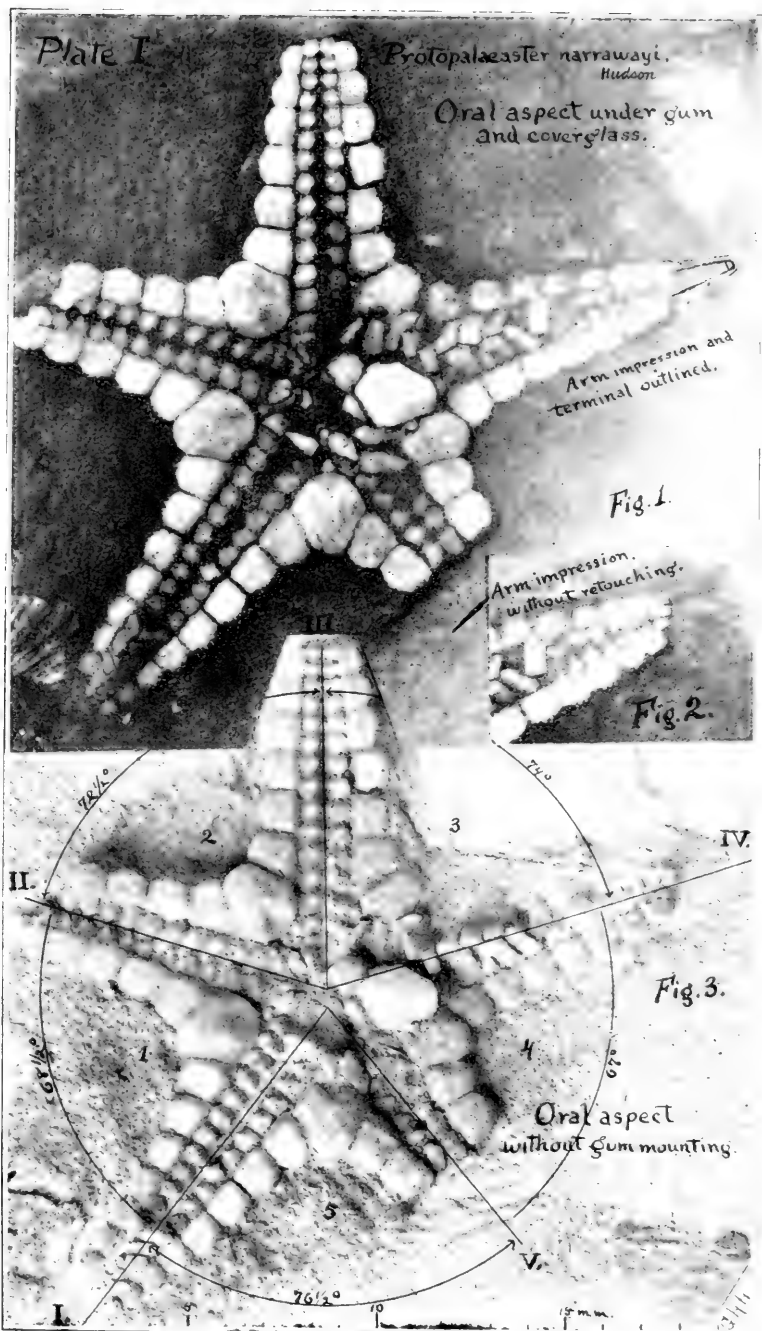
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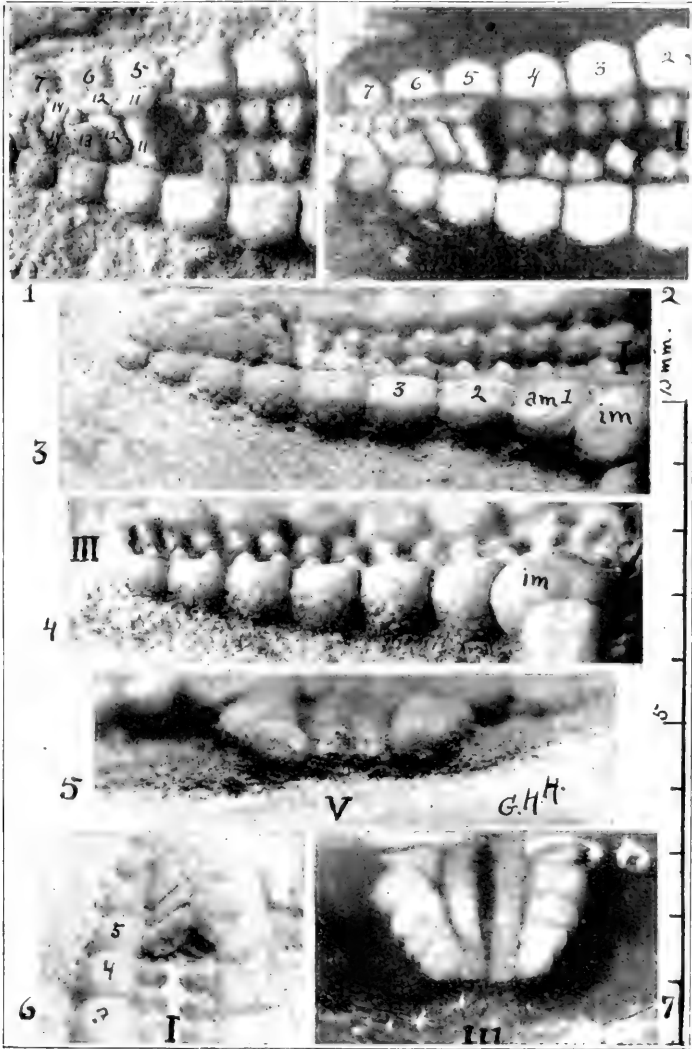
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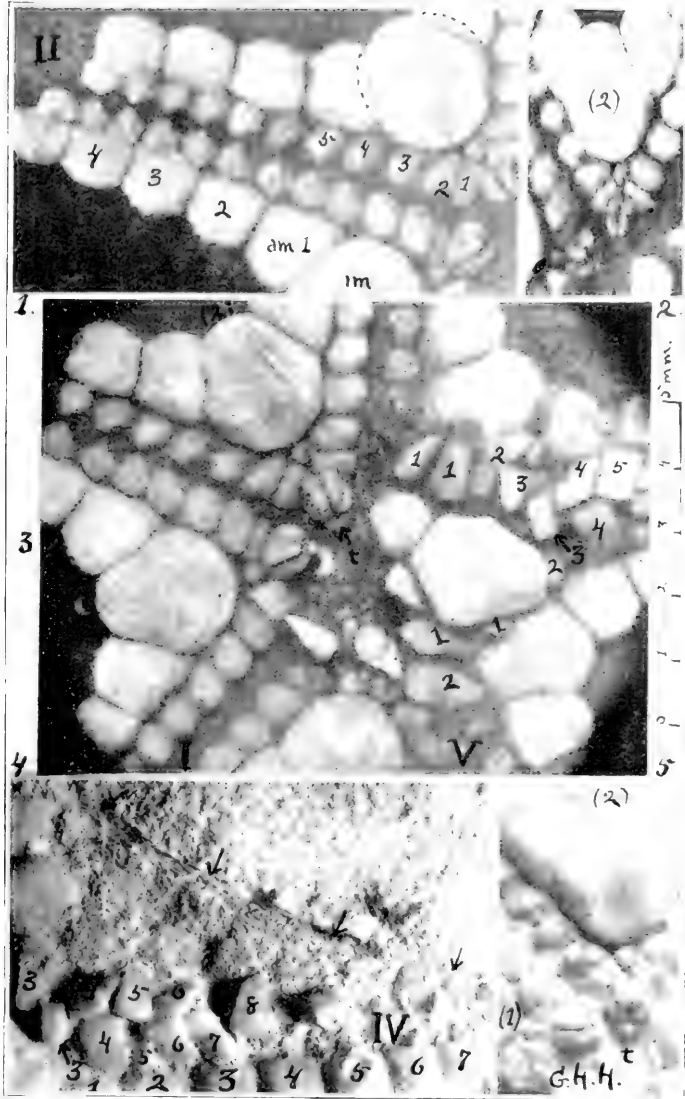
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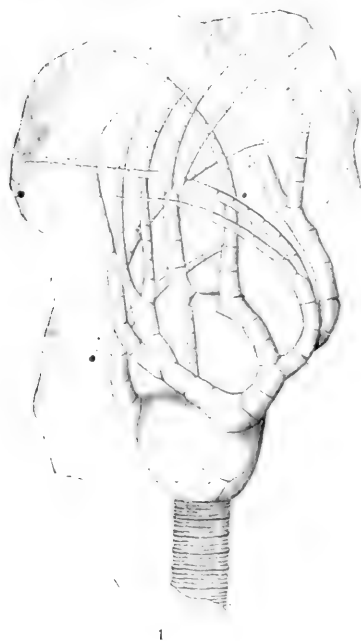
Protopalæaster narrawayi, Hudson.



Different arm views of *Protopalaeaster narrawayi*, Hudson, enlarged nearly nine and a half diameters. Millimeter scale at the right. Photomicrographs for figures 2, 5 and 7 were made under gum and coverglass.



Different views of portions of the disc of *Protopalaeaster nurrayi*, Hudson, enlarged nearly nine and a half diameters. Millimeter scale at the right. Photomicrographs for figures 1, 2 and 3 were made under gum and coverglass.



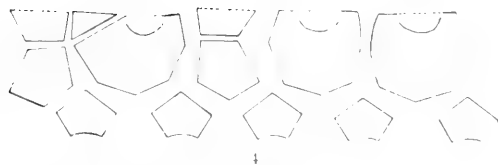
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***Glaucocrinus falconeri*, sp. nov.**

Fig. 1—Viewed from the posterior interray, nat. size.

Fig. 4—Dissection of cup, nat. size.

***Glyptocrinus circumcarinatus*, sp. nov.**

Fig. 2—Composite figure from two specimens, nat. size.

Fig. 3—Dissection of cup, nat. size.



PALÆASTER? WILSONI, RAYMOND

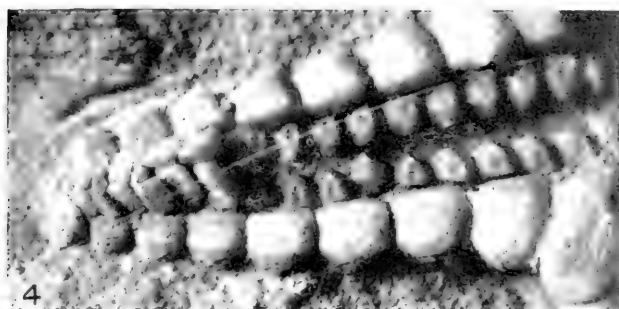
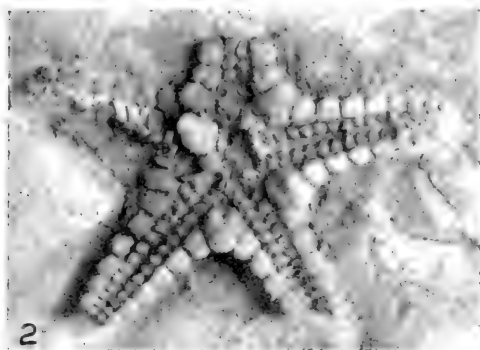
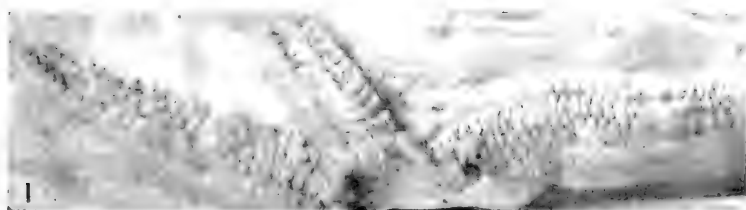


Fig. 1. *URASTERELLA PULCHELLA* BILLINGS : FIGS. 2, 3.
PROTOPALAEASTER NARRAWAYI, HUDSON.



Figure I. Devonian limestone cliffs on Snake Island, Lake Winnipegosis.



Figure II. Ripple-marks on a block of limestone from the face of the cliff shown in Figure I.





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